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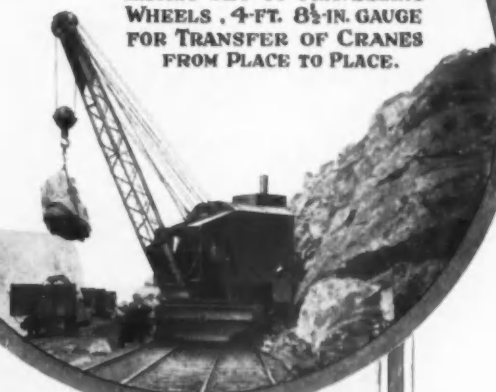


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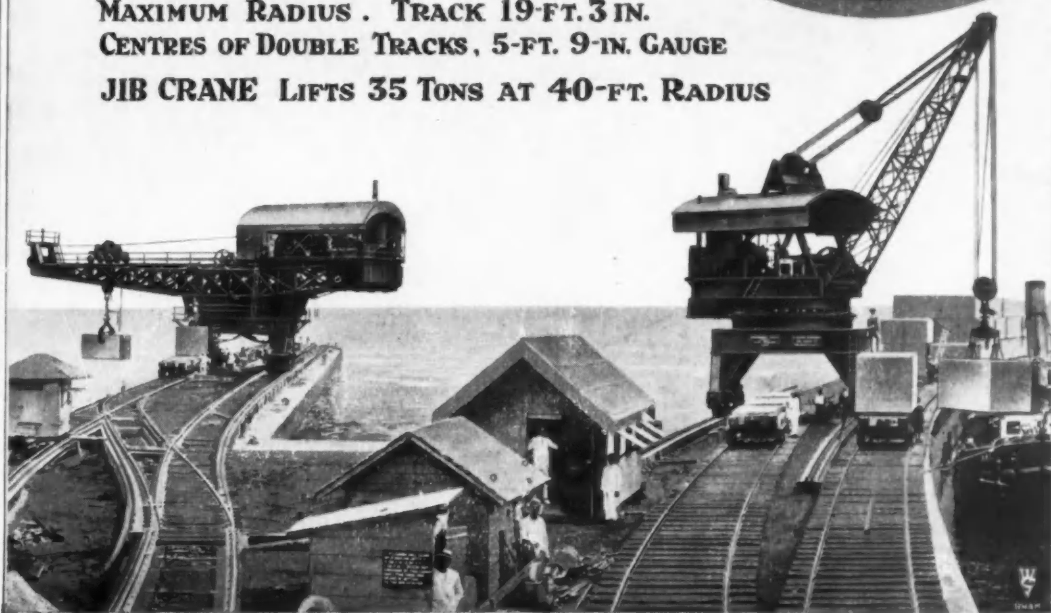
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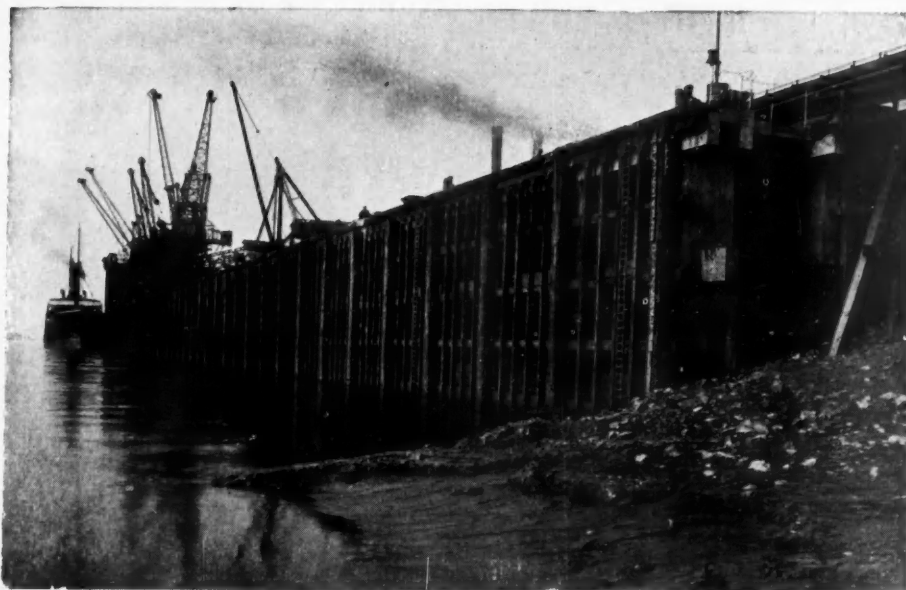


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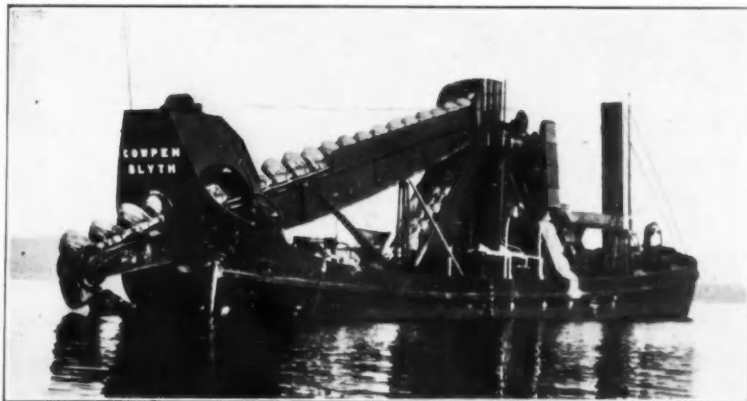
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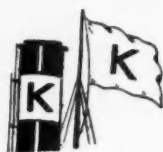


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The Dock and Harbour Authority

No. 255. Vol. XXII.

Edited by BRYSSON CUNNINGHAM, D.Sc. B.E., F.R.S.E., M.Inst.C.E.

JANUARY, 1942

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Editorial Comments

New Year.

In conveying to our readers, the customary, but none the less unfeigned, message of good wishes for the coming year, we feel it must be admitted that the omens are not quite so auspicious as they appeared to be at the opening of the year which has just run its course. Twelve months ago the country looked forward, perhaps with somewhat undue optimism, to an imminent favourable turn of the tide of war; in fact, the ensuing series of rapid successes in Abyssinia, Eritrea and Libya gave ground for believing that there was a reasonable prospect of such a hope being realised. Before the close of the year, however, that rosy vision had faded away. Serious reverses have been experienced, from which it is not to be expected that there can be any rapid or miraculous recovery. It is generally admitted in competent quarters that there still lies ahead a period of stern trial, which will call for courage and fortitude on the part of the British people and their allies in the struggle for freedom and right.

It is incumbent on this country to respond to the call with the fullest measure of loyal co-operation. Despite the menace of the lowering clouds overhead, it is possible for our readers to look at the brighter horizon in the distance and to feel an assurance of the inevitable ultimate return of serenity and peace. So we reiterate the time-honoured greeting: A Happy New Year.

Hong Kong.

So rapidly have events, tragic and disastrous, developed in the Far East following the entry of Japan into the war, that a perilous crisis in the situation at Hong Kong arose and has overtaken the publication in this Journal of Sir David Owen's epoch-making Report, in which are put forward far-reaching proposals for the future administration and control of the port. In the light of recent events and those which may take place in the future, the whole matter may well call for fresh consideration at the close of hostilities, and, assuredly, under present conditions, the various proposals have little more than academic significance, since the physical state in which the harbour has been left, after heavy bombardment and gunfire by contending forces, can only be a subject for speculation, and that not of a very favourable character.

These remarks apply more particularly to the suggestions in the Report which relate to the development of the port's accommodation and facilities, included in the instalment published in this issue. Since, at the moment of writing, the whole of the colony, including Kowloon city and the mainland frontage, Victoria and Hong Kong Island, have fallen into enemy hands, it would be idle, and in any case, premature, to discuss the arrangements for berthage development in the harbour. Naturally, we fully hope and expect that the great port and emporium in Eastern waters will be recovered and long survive as a strategic centre of British trade, and that there is a future of enhanced prosperity awaiting it. But, for the time being, it seems more discreet to observe some degree of reticence and to reserve comment until the situation becomes less obscure.

Only a few months back, the colony, amid general rejoicings, was celebrating its centenary. It is a sad commentary on the instability of human affairs, that the British community has since been engaged in a life and death struggle for very existence.

War-time Traffic Conditions at United States Ports.

The problem of traffic congestion in war-time is not confined to British ports. It was experienced in America during the last war to an extent almost equal to that at ports in this country. Taking a useful admonition from the past, American port authorities have initiated measures to prevent a recurrence of the evil and Mr. George Randall, manager of port traffic of the Association of American Railroads was able to announce recently that the Port of New York, as also the other leading ports on the United States seaboard, were free from traffic congestion, in favourable contrast to the situation during the last war. The credit for this was due, he stated, to the "co-ordinated efforts of railroads, steamship companies, shippers, brokers and forwarders."

Speaking of the Port of New York to members of the Foreign Commerce Club, he said: "Unloading of export and coastal traffic has increased from an average of fewer than 500 cars" (i.e., covered trucks) "per day in the early months of 1939 to more than 1,175 cars per day in a recent week in October." Even so, there was ample storage accommodation and "by any measuring stick the situation at the Port of New York is liquid."

Explaining the development of control, he said that, "desirous of avoiding a repetition of the last war's congestion, the Association of American Railroads in November, 1939, appointed a manager of port traffic and evolved a system of reports which show twice a week the number of cars unloaded in every port and the number of cars on hand; and once a week, the number on hand for fifteen days or more." In New York a joint steamship and railroad committee was formed to expedite traffic.

"Whereas prior to its organisation," Mr. Randall continued, "it was not uncommon to have 150 or more lighters held over 48 hours reported each morning, to-day, although the volume of lighterage freight has increased over 100 per cent., the number of lighters held over 48 hours has decreased nearly 50 per cent. Incidentally, the tonnage per lighter has substantially increased."

The American authorities are to be congratulated on the success of their measures for handling this difficult problem which, of course, though there is similarity in some respects, presents features of a kind not identical with the conditions at British ports.

Pilferage at Docks.

We have frequently called attention to magisterial utterances on the prevalence of thieving at ports in this country and now we learn that thefts from the docks at Cardiff and other South Wales ports have, under war-time conditions, reached such alarming proportions that representatives of employers, workmen and various interested official bodies have taken action and are collaborating in devising traps for the detection of the culprits. The losses, which are said to be extremely heavy, rarely come to light until a vessel is discharging at the foreign port for which she was bound. Specially selected police officers, as well as military and naval officials, have been assigned to ships carrying cargoes liable to be exposed to the depredations of thieves, working either singly or in gangs. This measure has had a certain amount of success, but the evil persists to a disquieting degree and it is becoming increasingly difficult to counter the ingenious stratagems employed by nefarious individuals. Some extremely drastic remedy is clearly required.

*Editorial Comments—continued***Shipping Document Delays at Australian Ports.**

Attention may be called to the fact that as regards overseas shipments, it has been difficult for some time to dispatch shipping documents so as to arrive at the ports of destination ahead of, or simultaneously with, the goods to which they refer. This has caused inconvenience to consignees and others. In default of the essential documents it has not been possible to collect the goods at the ports, or, alternatively, they could only be obtained on the presentation of bankers' guarantees. That resort is not always had to this method of securing release is evidenced by a statement issued by shipping lines in the Australian service, calling the attention of shippers to a serious congestion of cargo at Australian ports due to delays in clearing the goods through the Customs.

The circular urges shippers to forward their Customs documents, whenever practicable, by the ships' letter bags, whether the bills of lading are ready or not, and failing this course, to send the Customs documents by air mail. Shippers are also asked to lodge bills of lading as soon as possible, in order that the ships' manifests may be completed promptly.

City and Port Civilities.

There is something specially apt and fitting about certain ceremonial visits which have been paid of late by civic authorities to neighbouring port areas. At Cardiff the Lord Mayor has made a courtesy call at the docks of the city, where he was received by the President of the Chamber of Commerce and the Council, as representing the mercantile and shipping communities, while at Southampton a similar official visit has been paid to the docks in that locality by the Mayor, accompanied by the Sheriff and Town Clerk.

At the last-named port, the Mayor, in acknowledging the welcome and hospitality extended to himself and colleagues alluded to the "close relationship existing between the town and the docks," paying at the same time a tribute to the gallant men who went out from the port in craft of local shipping companies to assist in the evacuation of the British Expeditionary Force from Dunkirk. Mr. H. A. Short, acting docks and marine manager, replied for the Southern Railway. He said that "to the superficial observer these inter-changes of visits might appear of small consequence, but they represented a fundamental principle which had operated in Dockland for many years."

There will be general agreement about the wisdom of this manifestation of reciprocal interest of town and port in each other's domain; for joint action in the promotion of the common welfare is much to be desired. Abundant opportunity for co-operation will be afforded in the era after the war, when reconstruction problems have to be faced and solved with due and mutual regard for the prosperity and advancement of both city and port.

Siberian Port Development.

Reports have been received from Washington, U.S.A., to the effect that two new ports have been put into commission in Siberia to receive shipments from America. The ports are Nogaev, some hundred miles north of Vladivostok and Petropavlovsk Kamchatski in the peninsula of Kamchatka. The following particulars of the ports are taken from a recent statement contained in *Lloyd's List*:

Nogaev was built some time ago by the Soviet Union as a model port, to serve as terminus for a rail freight line which was built north of and parallel to the main trans-Siberian railway. The line was built to Vladivostok, but the extension to Nogaev was never completed. Excellent highways now connect the new port with the railway. It is planned to ship the less heavy and cumbersome war supplies to the port, whence they will be moved by motor trucks (many of them being supplied by the United States) to the railway. Ships sailing for Nogaev can take a route across the Pacific north of the steamship track to Vladivostok. It is possible to proceed through the Kurile Strait, which separates the northernmost Japanese islands (all small and believed unfortified) from the Kamchatka Peninsula, thence across the Okhotsk Sea, round the northern point of Sakhalin Is., from which point it is a short trip south to Nogaev.

Petropavlovsk Kamchatski is a large fishing port. The Russians have recently developed the harbour. It is understood plans have been made for small vessels to unload their cargo there for transfer to fishing vessels, a large number of which have been mobilised by the Soviet Government, for transport to Nogaev.

In addition to the foregoing, the Soviet Government have now decided to construct two entirely new ports at the mouth of the Yenisei River, in Western Siberia, to be ready for the 1942 summer season, in case the Archangel and Novgorod routes for shipping are rendered unusable. The names assigned to these new ports are Novyport and Igarka. In view of the world-wide extension of hostilities, this action by the Russian authorities is judicious and well-timed.

Civic Re-planning at Southampton.

An interesting report on the replanning of the town and Port of Southampton, consequent upon air raid damage, has been dis-

cussed at a recent meeting of the Southampton Civic Society. The report stated that the replanning of the town resolved itself into two stages: "(1) the drafting of a master plan for the whole of the borough on a long-term basis, including the planning of main through roads and (2) the immediate rebuilding of damaged areas of the town to conform to the master plan." The docks inevitably came into the picture. "Being a gateway to the country from overseas, their connection with the centre of the town and with the main traffic routes should be planned with suitable dignity."

Among the suggestions made regarding industrial installations was one that only smokeless industries should be permitted on sites adjacent to the new docks. On the proposition of Mr. M. G. J. McHaffie, the docks engineer of the Southern Railway, a resolution was passed to the effect that "any industry involving smoke emission from their premises should be required to install smoke-washing apparatus," and this was defined as applicable to the town as a whole.

The stipulation is one which should receive the careful consideration and, indeed, the approval of all port authorities for enforcement as far as practicable in the areas for which they are responsible.

Shortage of Barges on German Canals.

According to instructions which are reported to have been issued by local administrations of the German system of inland waterways, inland waterway craft are not to be used for storage purposes except by special permission. These instructions have recently been applied in particular to harbours and transshipment centres in Pomerania, on the Rivers Oder and Warthe and their connecting canals. Similar regulations are also being enforced on the West German canals, the Mittelland Canal and the River Weser. From these and other indications which have filtered through from the Continent, it can be inferred that the Germans are experiencing a shortage of barges for canal and river traffic, which is so important a feature of their internal transport system.

The bombing of railways and storage depôts and the frequent sinkings of coastwise craft have intensified the demand on canal carriage and it is not surprising that the need for barges should have become acute.

The significance of the inland waterway transport system of Germany, is perhaps not fully appreciated in this country where canals have occupied a very subordinate place in the internal traffic scheme. It was stated by Herr Leopold of the Ministry of Communications at the 1935 International Congress of Navigation that inland shipping accounted for from about one-quarter to one-third of the total traffic on German railways and waterways. Hence any shortage in barges must have an important bearing on the carrying capacity of the transportation system as a whole.

Further evidence of stringency is forthcoming from a decree issued by the Ministry of Communications that work of loading and discharging inland vessels in the river areas of the Rhine and Weser (except the ports on the lower Weser and Bremen-Hemelingen) and on the West German canals may be carried on for two hours beyond the permitted hours of 6 a.m. to 8 p.m., in order to speed up the turn-round of ships.

The information will be received with satisfaction by the British public who will see in it signs of an increasing stranglehold on the economic system of the Axis powers.

Dock Labour Results.

There was a distinctly optimistic tone in Mr. Ernest Bevin's reference to the working of the dock labour scheme, made during his speech in the House of Commons in early December, on the subject of man power. He expressed himself as satisfied that the difficulties of the casualness of dock labour has now been overcome, and averred that the National Corporation recently established was an accomplishment of which he was proud. Indeed, he went on to say that he thought the principle might advantageously be extended in the post-war period in a number of directions "without destroying initiative or enterprise."

We have no wish to detract from the sanguine outlook thus envisaged, and, indeed, hope that Mr. Bevin's anticipations may be realised to the full. At the same time, we may be forgiven for thinking it desirable to await the result of a rather longer period of testing than has so far been possible. Mr. Bevin claimed that as a result of the scheme, the time of turning round a ship had been reduced by nearly 2½ days. This, of course, is a remarkable improvement, but particulars were not given of the size of the ship nor of the nature of the cargo. Apparently the statement was intended to apply to a vessel of average tonnage, but even so, there are so many special conditions to be allowed for, that the criterion can only have a limited value. Any improvement, however, is to be welcomed and the case cited is definitely encouraging. The subsequent rather startling assertion in Mr. Bevin's speech, as recorded in the press, that the saving in time is equivalent to building nearly 1,500,000 tons of new shipping is vague and cryptic, since the basis of calculation is not disclosed.

The Port of Hong Kong

Report on Future Control and Development

By the late Sir DAVID J. OWEN.

(Continued from page 26)

61. **Present and Future Control of the Harbour.**—The above are all important factors in the Port problem, and I now proceed to the real question which arises out of them and which is, "The measures by which the Port could in future be developed and controlled to the best advantage of all persons and interests dependent on its services."

62. "Control" is the first point and, of course, development, physical and otherwise, is bound up with it. The vital point is who should control or administer the Port?

63. It seems to me that there are three courses open, and three only, they being:—

- a) To allow matters to remain as they now are;
- b) To adopt some improved method of Government control;
- c) To establish control by some form of Port Authority or Trust.

64. Course (a) "To allow matters to remain as they now are" obviously requires to be cleared up first of all, because if the present state of affairs should be proved to be perfectly satisfactory then (b) and (c) need not arise.

65. As things are, the Government of the Colony may be said to control or administer the Harbour, as they own all the land and have granted the leases under which the piers for shipping have been constructed, and they have laid down mooring buoys for vessels, as well as providing navigation lights. Apart from this there has been very little control or administration, it having been left to private enterprise to do all else that was necessary, and it must be admitted that private enterprise has succeeded to a remarkable degree in meeting the needs of the situation.

66. So far as the Government is concerned, the Harbour is not treated as an entity in itself. As already mentioned it comes within the purview of various officials in so far as their respective general duties impinge upon it. The Director of Public Works, for example, deals with the Harbour among the public works of the Colony, the Land Department issues the pier leases as part of their duty to deal with other leases, while even the Harbour Master is concerned with duties other than those relating strictly to the ordinary duties of such an official.

67. The accounts of the Harbour are not kept separately, so that it is impossible easily to compare the revenue derived from it with the expenditure on it, but it would appear that the revenue from light dues, buoy dues, rents of piers and ferry royalties exceeds any expenditure which should be charged against it.

68. It may be further noted that there does not seem to have been much in the nature of planning for the future development of the Port, although I am bound to mention that Mr. Andrew Nicol, A.M.Inst.C.E., the Engineer in charge of the Harbour Works, has displayed a deal of foresight in many plans which he has prepared for dealing with certain aspects of the physical side of the Port. There has, however, been no officially adopted plan of development, and it is practically impossible for the ordinary civil servant, having regard to his general duties, to do much in that direction.

69. As stated in paragraph 25, Hong Kong owes its trade and prosperity largely to its magnificent Harbour, so much so that it may be said that the Harbour is the Colony and the Colony is the Harbour. Jealous eyes have been cast at it, hence we hear from time to time of schemes for the establishment and improvement of other Ports, with the object of robbing Hong Kong of its trade.

70. All this makes it important that the Port of Hong Kong should be carefully nurtured by keeping its facilities adequate, and, above all, the burden of its charges as light as possible. Here I

may remark that I am struck by the lowness of the charges which the principal godown Companies are able to make, they being lower than those at any of the many Ports of which I have knowledge.

71. If things are to remain as they are, the Government presumably would have to renew the pier leases on their expiration, for such further periods as they thought fit and at appropriate rents, which could reasonably be higher than those at present in force, so giving security of tenure to the leaseholders and enabling them to develop as they saw fit in the future.

72. So far as the larger ocean-going vessels are concerned, there would not seem to be any fear that private enterprise would not meet the situation if the leases were renewed, but it has to be remembered that there are other services—coasting and river—that are not in such a satisfactory state as regards their accommodation.

There are many piers that have been allowed to get into a bad condition, private enterprise not having dealt with them too kindly. Private enterprise may provide all that is necessary for a section of the trade, but fall short in other directions.

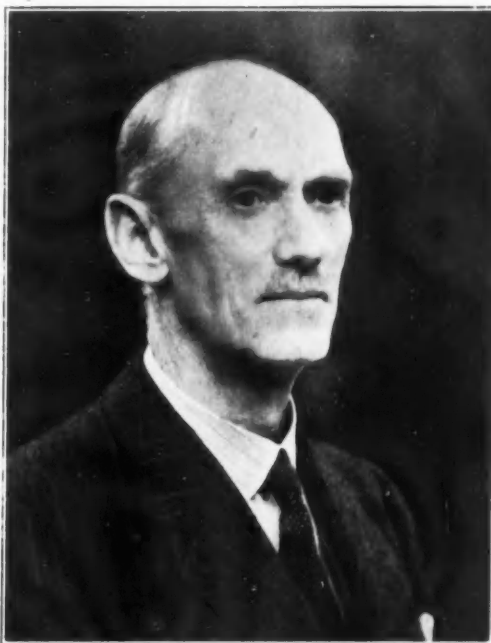
73. I think that the doctrine of "laissez faire" well describes what has been the attitude of the Government to the Harbour, and, taking everything into consideration, I am of opinion that, in the best interests of the community and of the Colony in its broadest sense as a source of supply of trade to the Empire at large, it is not desirable to allow matters to remain as they are.

74. The course (b) mentioned in paragraph 63, therefore, requires consideration, that is, whether some improved method of Government control could be devised. One way would be to form a special Government department for the purpose of controlling the Harbour, with possibly an outside Body to advise on Port matters. There are not many Ports in the British Empire run by the Government, in fact, I believe this is the case only in South Africa where the Government there own and control all the railways and harbours. A Minister of the Government is responsible and directly under him is a

General Manager in charge of the railways and harbours. This system does not prove altogether satisfactory to the commercial community, although the Government of the country is on a democratic basis and members of the Legislature can air the grievances of their constituents. In Hong Kong there is no form of democratic Government, that being obviously impossible in the circumstances. Control of the Port, even by a special department of the Government of Hong Kong, would in effect be bureaucratic control, and that form of control is not highly regarded now-a-days. It is feared that it would hardly make for cheapness.

75. In South Africa again, there is a Harbour Advisory Board at each Port, but this also does not give satisfaction. Such Boards can only express opinions and make recommendations without any guarantee that they will be carried out, and it is hardly within the capacity of human nature for a person to spend much time and thought on the problem of Port development with a fruitless result.

76. I therefore rule out direct Government control in the form mentioned, even with the assistance of an Advisory Committee. In this connection I would refer to the Advisory Board and Committee alluded to in paragraphs 11-15. It is interesting to note what has been done in Hong Kong in that way, for it clearly indicates, as it were, a groping in the dark for some solution of the Port problem. I can only remark that in some respects the constitution of the first Advisory Board seemed hardly a happy one. For instance, the appointment of a Government official in the person of the Harbour Master as the Chairman, could scarcely be expected to lead to the best results, and this not from any personal point of view, but from that of his office.



Mr. DUNCAN KENNEDY, M.Inst.C.E.
Engineering Adviser to Sir David Owen in connection with the Report.

Port of Hong Kong—continued

77. There remains, therefore, course (c) to be considered, that is, whether some form of Port Authority or Trust would meet the case. There is widespread fear among the mercantile interests in the Colony that such a body would inevitably increase the charges on vessels and goods, and this seems to be founded on the assumption that the creation of such a body would mean the acquisition by that Body of all the piers and godowns and the operating of them by that Body. I must, however, point out that by no means is that necessarily so.

78. The misconception may perhaps have arisen from a statement made by Messrs. Coode, Fitzmaurice, Wilson and Mitchell, Consulting Engineers, who were asked to advise on certain Port matters some time ago. In their Report dated 24th November, 1922, they spoke of the possibility of the "formation of a Port Trust which would take over existing wharves and manage the new wharves and those taken over," the inference which might be drawn being that the formation of a Port Trust would necessarily mean their taking over and managing all wharves, etc.

79. Incidentally, Messrs. Coode and Company are against such a proposal, but the important point to be noted is that a Port may be "owned" or "controlled" by a state, a city, a corporation or a Public Trust, and yet not be "operated" by the owner. The distinction between "controlled" and "operated" as applied to a Port should clearly be borne in mind.



View of Channel, with Kowloon City above and City of Victoria below

80. "Control" denotes supervision, i.e., the drawing up of regulations and seeing that they are observed, and settling the policy, while "operating" is the actual handling and the business management of all work connected with the berthing of ships, the discharge of their cargoes and the removal of the goods to and from warehouses or godowns.

81. One Port Authority may own and control but not operate, a striking example being Liverpool where, however, while the general operating is left to private enterprise the Authority do carry on an amount of warehousing of goods. Another Port Authority may both control and operate, as at London. No one system can be laid down as the ideal, for it entirely depends on tradition, custom and local conditions.

82. It is, however, significant that a most of the Ports in the United Kingdom and the Empire, some form of Public Port Trust has evolved, the obvious lesson to be learned being that it has been proved to be for the best. I need only mention London, Liverpool, Glasgow, Belfast, Quebec, Montreal, Bombay, Karachi, Calcutta and Sydney, as a few notable examples of large Ports that have come to adopt the Public Trust system. Further proof of the efficacy of the Public Trust system is to be found in its extension to other spheres of activity connected with public services in Great Britain, as witness the Central Electricity Board and the London Passenger Transport Board.

Proposed Harbour Trust

83. I have come to the conclusion that it would be to the advantage of all persons and interests dependent on the Port of Hong Kong that a Public Trust should be formed to "control" the Port. I therefore make the following definite recommenda-

tions to each of which I have appended a note of explanation or reason for the proposal:—

- (a) That a Body to be called the "Hong Kong Harbour Trust" be established at the earliest possible moment.

NOTE.—There is no reason why the Trust should not get into being and to work as quickly as can be, notwithstanding war conditions.

- (b) That the constitution of the Trust be as under:—

Three Government officials of high standing, to be appointed by the Governor.

Three British subjects connected with the trade of the Port, to be appointed by the Governor on the nomination of the General Chamber of Commerce.

One person interested in the trade of the Port, to be appointed by the Governor on the nomination of the Chinese Chamber of Commerce.

One independent person of business experience and, if possible, with a knowledge of Port affairs, to be appointed as Chairman by the Governor, on the nomination of the other members of the Trust at a meeting duly held for the purpose.

NOTE.—I think the majority of the members should be other than Government officials, otherwise the Government might as well have direct control. Although the unofficial members might be in a majority on a question, there would always be the independent Chairman to balance the situation if needs be, and, if he thought fit, to use his casting vote.

In any case, with the safeguards later provided, it does not seem that such a Body could do anything prejudicial to the interests of the Government or the Colony, even if it wished.

I have provided for all the appointments as Trustee to be made by the Governor who could always veto anyone if he thought him for any reason an undesirable person for the position.

Such a Body, carefully selected, should gain the confidence of the Government and of the commercial community. The members would in fact be Trustees for both.

As to the three Government officials to act as Trustees, the Governor would know who would be the most suitable. I can suggest the Director of Public Works as one likely official, but I think that if the Governor considers it wise to have the Navy represented a Naval officer should be one of the three and not an addition.

So far as the proposed Chairman is concerned, I do not consider that should prove a difficulty. It might be desirable to seek one from Great Britain or some other part of the Empire, but not necessarily if there are suitable persons in this locality who are not actively engaged in business connected with shipping.

- (c) The Trustees, other than the Chairman, to be unpaid, but the Chairman, who would be required to devote a large portion of his time, though not perhaps the whole, to his duties, to be paid a suitable annual fee.

NOTE.—I should think there are sufficient public-spirited men in Hong Kong who would undertake the duties of Trustee without any pecuniary remuneration. There was evidently no difficulty in getting persons to act on the Advisory Board and Committee.

- (d) This Body of Harbour Trustees to remain in being for three years, as an experiment.

NOTE.—I make this suggestion, as the idea of a Port Trust is a new one for Hong Kong, and in certain quarters might be viewed with apprehension. A trial period of three years would enable the Trust to justify its existence, while the experience gained would show in what direction some modifications, if any, might be necessary.

To put it on a very low level, the Trust could do no harm in that period.

When established on a permanent basis, I would suggest that the appointment of Trustees should be in each case for three years, they all being eligible for re-appointment—of course at the discretion of the Governor.

It might, however, be desirable to appoint the Chairman on a more permanent basis.

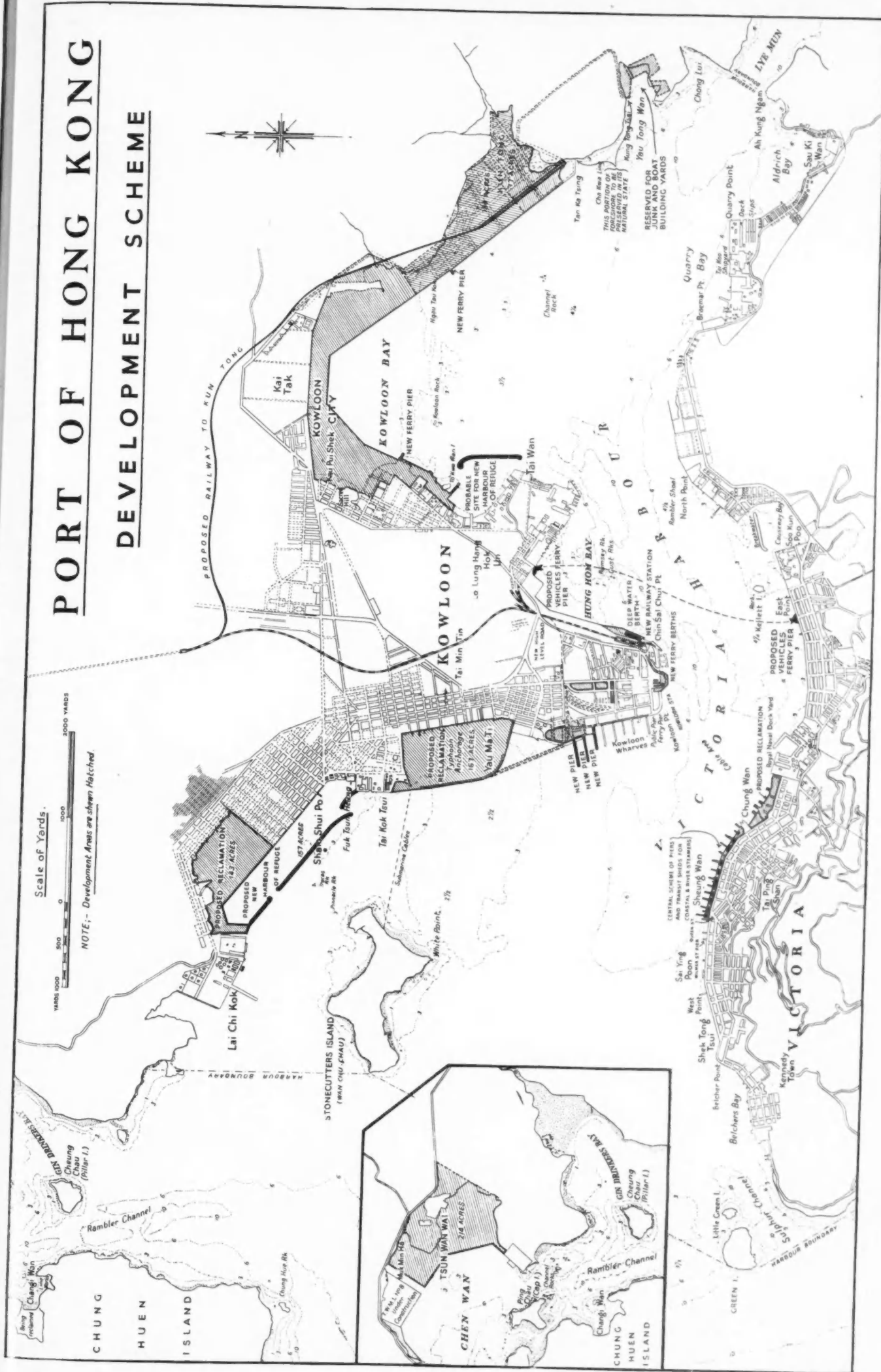
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PORT OF HONG KONG

DEVELOPMENT SCHEME



Port of Hong Kong—continued

- (e) The matters over which the Trust would have control, to be:—

Leasing or letting of piers.
Construction of new piers as and when necessary, and the charges therefor.
Lights and buoys (Navigational) and the charges therefor.
Mooring buoys and the charges therefor.
Ferries and the royalties, etc., therefor.
Dredging the Harbour as required from time to time.
Licensing of pilots.
Regulation of Harbour traffic and the promulgation of the necessary by-laws for that purpose.
The general policy of the Harbour.

NOTE.—These are the matters usually under the control of Harbour Trusts.

The three years' experimental period would, as already mentioned, disclose whether any addition should be made to these functions or whether any modification of them would be necessary or desirable.

- (f) The rents of the piers, the charges for the use of mooring buoys, the charges levied upon the ferry owners in the form of royalties, etc., and the light dues to be paid to the Trust.

NOTE.—Out of these revenues the Trust would pay the remuneration of the staff provided for in the next paragraph, as well as the cost of maintaining the lights, buoys and ferry piers not belonging to the ferry concerns. Government piers would, of course, be maintained by the Government.

- (g) No charges or rents to be levied by the Trust without the consent of the Governor thereto having been first obtained.

NOTE.—It is customary in Port Trusts for the legislature to fix a maximum scale of charges beyond which the Trusts cannot go without further Parliamentary sanction. This proviso is made with the object of protecting the public, that is, the shipowners and merchants, against unduly heavy charges, although naturally it is to the interest of the Trusts to keep their charges as low as possible. I have inserted this provision with an eye not only on the maximum charges but on the minimum as well. It might be conceivable, for instance, that the proposed Trust would suggest too low rentals for the renewal of the pier leases, in which case the Governor could refuse his sanction and call upon the Trust to reconsider the matter. At the same time, as far as I can gather, the holders of the pier leases which expire in 1949, do expect to be charged higher rents for renewals, but not unreasonably higher. What would be a fair rental is the crux of the matter, but it should not be difficult to arrive at it.

- (h) The necessary staff for the working of the Trust to be supplied by the Government from their official establishment, for the experimental period of three years.

NOTE.—I visualize at the end of the three years a permanent Trust with its own staff. This staff should not be a large one, in fact, it should be kept as small as possible, and would consist of a small secretariat, an engineer with the necessary assistants and a Harbour Master without any extraneous duties.

It should not involve, on the whole, any staff increase to the present Government establishments, for, as the Trust would merely be taking over duties now performed by the Government, all that it should mean would be a transfer of staff, which should not be a real difficulty if the staff were guaranteed no worse terms and conditions than they now enjoy. The superannuation might present a difficulty, but seeing that the staff entered the Government service in the first instance it would only be fair for the Government to assume the responsibility for the superannuations.

- (i) The Trust to regulate its own procedure, with the proviso that a quorum at any meeting should be four, but no Trustee to be allowed to vote on any question *directly* affecting his own or his firm's business.

NOTE.—This is common form.

- (j) The policy to be adopted by the Trust to be that of seeing that adequate and proper facilities are available in the Harbour for ships and their cargoes, but to allow approved private enterprise to provide these facilities, as far as possible, and also let private enterprise do its own "operating."

NOTE. I would strongly recommend this line of policy, having regard to the conditions in Hong Kong. It would mean that the leases of the existing piers would be renewed and new ones granted as occasions arose, although, as I mention later on, it might be wise for the Trust to construct some new piers to replace those that are dilapidated, and let them at appropriate rentals. In all cases, however, the lessees or tenants themselves should be left to "operate" the Piers without interference, so long as they coped with the requirements of the trade of the Port. In this way there should not be any fear of increased charges on the shipping trade.

On the matter of renewing the leases of the Piers on their expiration in 1949, I might venture to suggest that the term of the renewal is perhaps not very important if the lessees knew that the policy to be adopted was as indicated herein. A period of ten, or perhaps twenty, years with the option of further renewal at the end of the term, might be regarded as sufficient to give them security.

I should like also to emphasise that it would seem desirable that every future lease should stipulate that the lessee is to use the pier only for the purposes of his own business, which must be connected with shipping and that under no circumstances will sub-letting be allowed. I understand that some lessees have sub-let their piers at a profit rental which increases the charge the sub-tenant levies on ships using the pier. This is highly undesirable.

A provision that the lessees must properly maintain their piers should also be inserted.

It is, of course, not impossible that, in the course of time, conditions might change considerably and private enterprise fail to function satisfactorily, in which event another problem would arise, the solution of which might involve some form of "operating" by the Harbour Trust, but that is looking at a remote contingency. I should not now give the Trust power or authority to "operate." If the necessity should ever arise, the Trust would have to seek the necessary power or authority from the Government.

Before leaving the question of the policy with regard to the leasing of piers and of allowing private enterprise to do the operating, I would like to mention that it has been put to me that there is legislation in various parts of the world, such as Australia, whereby the Authorities can prevent new enterprises being formed for putting steamers on runs when the particular run is sufficiently well-served, thereby preventing suicidal competition and waste, etc. This aspect of the matter has not been lost sight of by me. I can easily imagine a similar case arising apart from any special steamer service. It is quite conceivable, for example, that a rival concern, more or less financially sound, might be formed to compete with, say, the Hong Kong and Kowloon Wharf and Godown Company. The new concern would require a wharf or wharves and would have to approach the Harbour Trust for the necessary lease, but the Trust would be right in refusing to grant any lease, for such a purpose unless it were proved that the existing facilities were inadequate. The same thing would apply if a pier were required for an unnecessary steamer service. Competition may be good in certain circumstances, but it is the generally accepted doctrine now, that unbridled or unnecessary competition is bad and wasteful. In stating this, of course, I need hardly say I hold no brief for any of the Hong Kong existing concerns, but, in the best interests of the Port, they would be entitled to protection if such a state of affairs as I have mentioned, arose.



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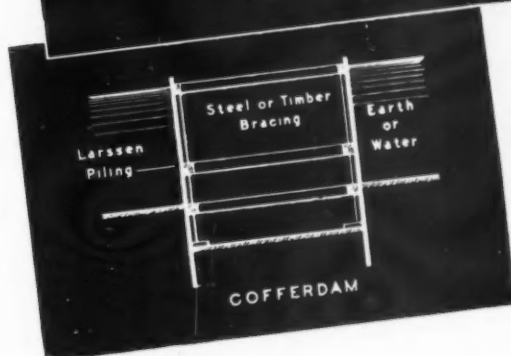
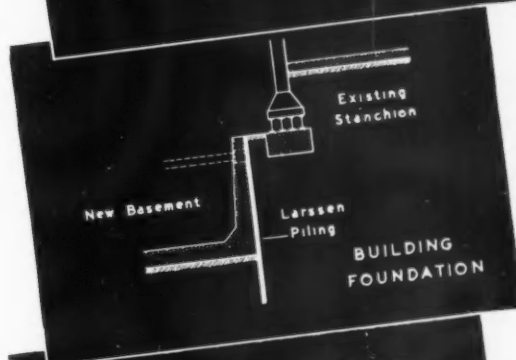
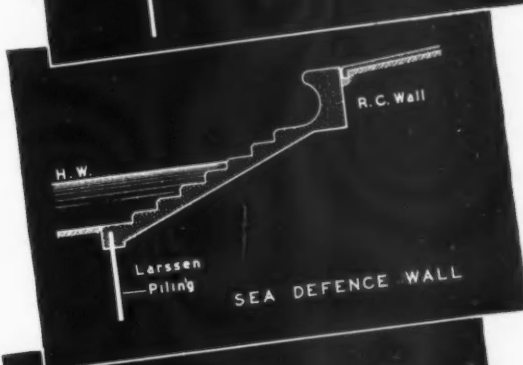
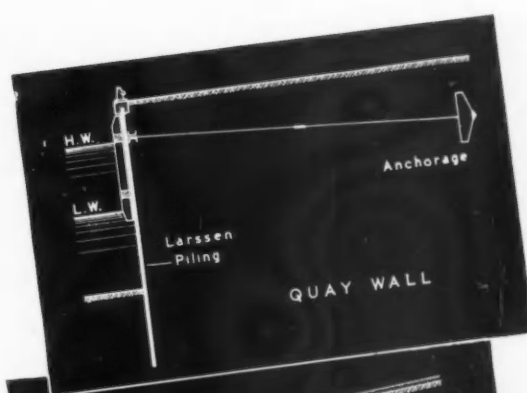


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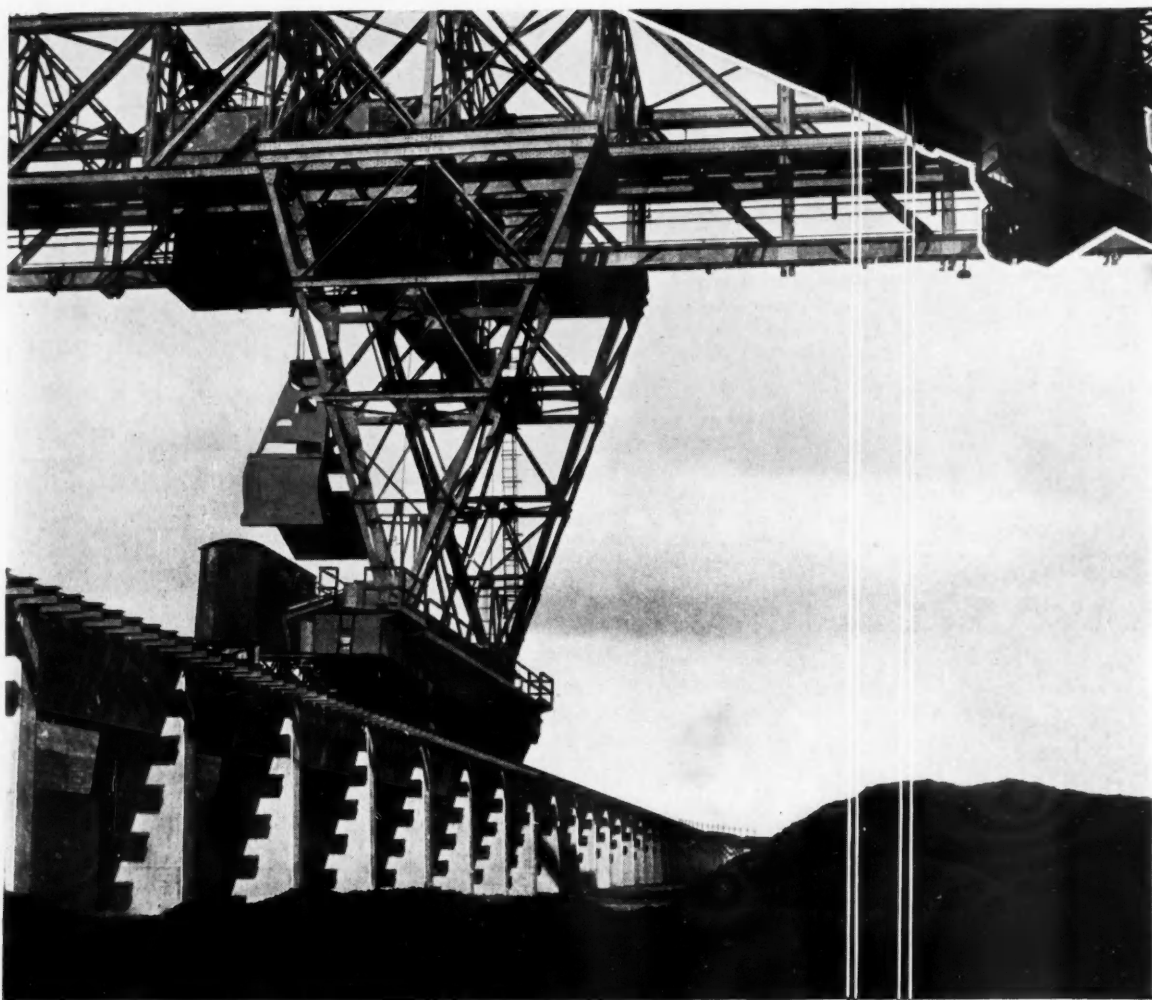
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Port of Hong Kong—continued

- (k) A statement of the receipts and expenditure of the Trust to be published annually.

NOTE.—It is very desirable that this should be done, as until it is done, it is hardly possible to deal adequately with the question of finance.

- (i) During the experimental period of three years, any surplus of revenue over receipts to be paid over to the Government and any shortage to be recouped by the Government.

NOTE.—I imagine that there should be a surplus. I suggest this provision for the experimental period of three years, as it would, in effect, practically leave finances as they are.

Should the accounts show a surplus, it would become a matter for consideration. In most of the Ports of the United Kingdom the Harbours were, in the early days, owned by the respective municipalities and the harbour revenues were received by the municipal Treasury and lost in the expenditure on municipal services, with the result that complaints were made that the shipping using the ports paid far too much compared with the services and accommodation it received—in other words the shipping was subsidizing the town. The Public Trust system altered this. How far this analogy applies at Hong Kong will be best known by the Government.

The principle underlying the Public Trust system of Port control is that shipping should only be taxed to the extent necessary to provide the accommodation and facilities it needs.

It is important to bear this in mind in Hong Kong. In a country or place which has to import goods for use or consumption within its borders, the argument may be used that the direct charges on shipping do not much affect the position. It is the goods that have to bear the cost of transport and it is the consumer who eventually pays all the costs incurred by the goods. Higher charges mean higher priced goods. This may start the usual vicious circle but that is another matter. What is of vital consequence is that in a place such as Hong Kong where the bulk of the trade is entrepôt in character, high charges on shipping would not affect the price of the goods to the consumer. Most of the goods are not consumed there and if charges were too high the goods would simply not come, which would be to the serious detriment of the trade and prosperity of the Colony.

- (m) At the end of the experimental period of three years, if the Trust is found to function satisfactorily, it should be established on a permanent basis, with the same constitution and duties, subject to any modification that may be desirable in the light of the experience gained.

NOTE.—It is hardly possible for me now to go closely into the question of finance which would arise. After the experimental period of three years the position should be clearer. The idea would be to make the Trust self-supporting and, from calculations which I have made on figures of expenditure, etc., supplied to me, I should not think that there would be any difficulty in this. The matter would require careful and sympathetic treatment at the hands of the Government, bearing in mind the vital part the Harbour plays in the economic structure of the Colony.

With respect to any capital expenditure for the construction of piers, the Government could borrow on behalf of the Trust and the rent of the piers so constructed would be sufficient to cover interest on capital, maintenance, etc. In fact, the Trust should not embark on any work involving capital expenditure unless the work would become self-supporting.

The question of the staff for the working of the Trust would also require careful consideration. One way would be to regard the personnel as still in the Civil Service, but their remuneration would be recouped to the Government out of the revenue of the Trust.

84. I have thus outlined my conception of the Trust which, after careful consideration, I recommend should be established as the solution of the problem of Hong Kong's Harbour. I have refrained from going into much detail, but, if the scheme be adopted, I presume it would be necessary to pass an Ordinance

authorising it, the exact scope and wording of which would be carefully attended to by the legal officers of the Government.

I can fully appreciate that difficulties of some sort are bound to arise in carrying the scheme into effect, but, if the proposals herein contained meet with the approval of the Governor, then with goodwill and determination on the part of the commercial interests coupled with the loyal co-operation of responsible Government officials, there should be no difficulty which cannot be surmounted.

85. I have been impressed not only by the great natural advantages of the Harbour, but by the enterprise of the members of the business community of the Port; they seem to be worthily carrying on the tradition handed down by their predecessors who, by courage and foresight, securely laid the foundations of this thriving Colony which is so valuable an asset to the Empire. I have no doubt that the same spirit will be brought to bear in connection with the proposed Harbour Trust with the result that in due time, after the existing world troubles are over, there should be still greater prosperity in store for the Colony.

Future Development

86. As the terms of my reference embrace the future development of the Port, I must deal with several matters concerning such development which have been brought under my notice during the Inquiry.

87. **Piers.**—As already stated, while the piers for the large ocean-going vessels have been maintained in a satisfactory condition there are several of those used by local shipping that are in a bad state. These bad piers are mostly situated on the water front in Victoria between Murray Road and Queen Street.

88. Mr. Nicol has prepared a plan showing a scheme for the widening of Connaught Road between the two points mentioned, and the construction of about 17 new piers, some intended for the shipping trade and ferry boats and others for official purposes. Apart from the necessity for new piers to replace the more or less derelict ones, Connaught Road has become very congested with traffic and should be widened sooner or later. Without destruction of property, this widening can only be accomplished on the water side, that is, by reclamation of land from the water. The scheme has the advantage that it effects this widening by a narrow reclamation, in addition to providing for the building of new and improved piers. It includes also a more extensive reclamation between Murray Road and Queen Victoria Street. The roughly estimated cost of that portion of the scheme between Queen Street and Queen Victoria Street is \$7,500,000 and of the remainder \$2,700,000, making a total of \$10,200,000. This is a bold scheme but an eminently desirable one and one that I recommend for carrying out as soon as practicable. In this I have the advantage of Mr. Kennedy's engineering advice. I may add that the premium on the sale of the land reclaimed between Queen Victoria Street and Murray Road is likely to be more than the cost of the whole scheme.

89. If the proposed Harbour Trust is to be created, this scheme would of course go before them for their approval. The Trustees from their own local knowledge would be quite able to subject it to proper criticism. I can only suggest the policy to be adopted in relation to it: The old piers that would be displaced are also shown on the plan. The leases for those piers expire with the others in Port in 1949. The lessees would be informed of the scheme and their leases renewed on very short terms with the intimation that when a new pier was ready for them they could rent it at a certain rental. Such rental would be based on a sum representing a small interest on the capital cost of the individual pier, plus the estimated cost of maintenance and a percentage on capital cost to cover depreciation. The total rent which the occupier would be called upon to pay therefore, should not put him in a worse financial position than he would be in if he built the pier himself. If any pier lessee wished to re-build his own pier on the lines shown on the plan I cannot see that there could be any objection, in which case he would be called upon to pay a similar amount of rent to that charged to the others who built their own piers.

90. I imagine that this scheme, if adopted, would be carried out in stages, so that the whole would take a number of years to complete. As the reclamation for the widening of the road would be for the benefit of the town, I assume the Government would defray the cost of that part of the scheme, but the Harbour Trust would pay the cost of the piers and then fix an appropriate rent for them as stated above. Of course Government would be responsible for the cost of any piers required for its own use.

91. If the scheme is carried out then the Harbour Trust would control many new piers, but under the line of policy adumbrated, the tenants of the piers would still do the "operating" and not the Trust.

92. So far as piers on the Kowloon side of the Harbour are concerned, they, as already stated, are in a satisfactory condition, and extensive enough to accommodate the volume of trade now using the Port. If, however, we can assume that the European War and the China-Japan War will come to a satisfactory end some time, there does not seem to be much doubt that the trade of Hong Kong will increase. Then the matter of further accommodation will arise sooner or later, and the question as to where

Port of Hong Kong—continued

new piers are to be constructed will become a pressing one. Messrs. Coode, Fitzmaurice, Wilson and Mitchell in their Report of 24th November, 1922, proposed a scheme for the construction of new piers in Hung Hom Bay on the east side of the Kowloon Peninsula. Having regard to the occupation of the land in this area, the scheme had no doubt much to recommend it. I consider, however, that before anything is done on the east side the capacity of the west side of the Peninsula should first be exhausted. The east side is exposed to the prevailing winds and typhoons, while the west is more protected. The piers and facilities of the Hong Kong and Kowloon Wharf and Godown Company are on the west side and their site may be described as the best in the Harbour for the large ocean-going vessels. To the northward of their premises there is room for about three more piers, but the site is occupied by the Royal Naval Depot. That Depot is somewhat cramped and seeing that it is not absolutely essential that it should be at that spot, arrangements should be negotiated for its removal to another site. There does not seem to be any reason why it should stand in the way of the development for commercial purposes of the really best site in the Port for those purposes. I understand that some negotiations have already taken place between the Hong Kong and Kowloon Wharf and Godown Company and the Admiralty; these will no doubt be encouraged.

93. If this removal were effected and the need arose later for more piers for shipping, doubtless the Godown Company, if they still displayed their customary enterprise, would be prepared to construct them, the necessary lease being granted to them.

In designing future piers, consideration should be given to the question of providing, on the piers themselves, transit sheds, passenger accommodation and railway sidings. The railway connections would necessitate taking over the Military lands to the south of Austin Road. The removal of the Military from their present position in the midst of a built-up area, would appear in any case to be overdue.

On the matter of passenger accommodation, I am informed that the Godown Company have a scheme for providing improved facilities on their Pier No. 1, and are prepared to put this in hand when they are assured of fixity of tenure and when the passenger traffic, which is now negligible under war conditions, justifies the measure.

94. When the possibilities of development on the west side have been exhausted then attention might be directed to something on the lines suggested by Messrs. Coode and Company, on the east side, with due regard to such changes as might since have taken place in development, but that would be a matter for the more distant future.

95. A plan is appended to this Report showing in tentative form, the proposed reclamation and new piers above suggested, and also certain other works which are dealt with in the following paragraphs:—

96. **Future Reclamations.**—I have excluded from the suggested duties of the proposed Harbour Trust, the matter of reclaiming land from the waters of the Harbour for the reason already given, that reclamations are not primarily intended to be for the benefit of shipping. I consider that the work of reclaiming should be undertaken by the Government, who however, would naturally consult the Harbour Trust on every proposed scheme, as it might affect shipping in some way. It is satisfactory to note that reclamation work generally pays, if not more than pays, for itself, on account of the valuable land so obtained.

97. I think that the following works of reclamation, which are shown on the plan attached, should be carried out by the Government as soon as practicable:—

- (a) The filling in of the present Typhoon refuge harbour at Mong Kok Tsui (167 acres) and the filling in of about 143 acres at Cheung Sha Wan, together with the formation at the latter place of a new Typhoon refuge in lieu of the former. The total area of land thus reclaimed, would therefore be 310 acres. The new refuge would, on the whole, be better than the old one from the point of view of protection from the winds. It is true it is a little further away, but the extra distance is so small as not to be any detriment. Mr. Nicol's very rough estimate, at to-day's prices, of the cost of the whole scheme, including the reclamation and the construction of the necessary sea walls, is \$12,000,000. I gather that the premiums to be obtained on the sale of the land so reclaimed, would be likely to amount to not less than \$24,000,000, while, in addition, the annual Crown rent to be derived from the land, based on present values, would be about \$109,700. It does not seem to be necessary to emphasise the desirability of this undertaking, which would give 310 acres of much-needed land for development, in addition to an improved refuge harbour.

At a future date, when the need arises for further piers beyond those mentioned in paragraph 92, it would be well to extend this reclamation to the dotted line shown on the plan. This would then involve the rebuilding of the vehicular ferry pier, which would be justified by the land reclaimed and the improved frontage line.

It must be pointed out that the estimates of cost of reclamation do not include anything for dealing with the sewerage problem in the vicinity of both of these reclamations. That would have to be faced but it would appear that there would be an ample margin of money available for that purpose.

I have not gone into detail with regard to the cost of each of these two reclamations, because it is impossible to regard them in any other way than as one scheme.

- (b) The reclamation suggested at Cheung Sha Wan would displace certain ship and boat building yards now situated there, and it is proposed that a small reclamation be carried out at Yau Tong Wan (near Lye Mun entrance channel) in order to accommodate the yards so displaced. This is a small matter and I have not enquired into the cost. An approach road would be required at this site.
- (c) The reclamation of about 214 acres of land at Tsun Wan should also be carried out. This land could be made available for building sites for residential, industrial and public purposes. The average depth of filling over this area would be small and the cost is roughly estimated at \$4,750,000. This scheme would undoubtedly pay for itself.

98. The following schemes of reclamation have been brought under my notice:—

- (a) Reclamation at Kun Tong and Ngau Tau Kok. The southern portion, at Kun Tong, with an area of about 77 acres, is at present reserved as a site for dumping town refuse, and a small area has already been reclaimed by this means. This is a slow process and the reclamation will take many years to complete. The adjacent northern portion, at Ngau Tau Kok, would provide an area of about 134 acres of land suitable for industrial and other purposes. This reclamation might be included in the programme of development, for carrying out as such time as circumstances indicate. Road, and probably rail, connections would be required and could be provided without great cost.
- (b) An extensive reclamation at Kai Tak solely for the air services, with a small typhoon shelter primarily for craft used in connection with those services. This is a large proposal which would involve a cost of anything up to \$12,000,000. I understand that the Government is expected to bear the whole cost of this scheme, and the point naturally occurs as to whether it would not be more economical to remove the Air Port to some other place, say in the New Territories. Air Ports cannot always be placed close to large centres of population.

(To be continued)

Petroleum Regulations in the Thames

An order, entitled the Petroleum Spirit (River Thames) Order, 1941, has recently been issued by the Minister of War Transport relating to the carriage and transport of petroleum in the River Thames, of which the essential provisions are as follows:—

No tug or self-propelling petroleum barge shall be in attendance upon or take in tow any laden petroleum barge, unless such tug or barge has been previously approved for that purpose by the Port of London Authority and has on board at least four fire extinguishers of a type and fitted in positions approved by the Authority.

Not more than four laden petroleum barges or such less number as may be specified in the approval given under paragraph 2 hereof shall be towed together by any tug or self-propelling petroleum barge.

When navigating the Thames above Chelsea Bridge no laden self-propelling petroleum barge shall approach and no vessel towing a tow shall proceed so that any part of the tow approaches within 300-ft. of any other laden petroleum barge except—(a) when navigating between the downstream end of Eel Pie Island and the upstream end of Petersham Eyot or between Richmond Bridge and Richmond Lock and Weir; (b) when passing such other laden petroleum barge in either direction, or (c) when necessary to avoid collision or danger.

No laden petroleum barge shall lie at a mooring or at anchor unless a tug is in attendance.

There shall at all times be on board every tug in attendance on laden petroleum barges at a mooring or at anchor in addition to the crew of the tug a number of competent men whose sole duty shall be the control and supervision of such barges, and no such man shall have the control and supervision of more than two barges.

Save when exceptional circumstances render such a course unavoidable, no laden petroleum barge shall lie at anchor or at any mooring other than a mooring previously approved for that purpose by the Authority.

The Order is embodied in Statutory Rules and Orders, 1941, No. 1900, Emergency Powers (Defence) Docks and Harbours, and may be obtained at H.M. Stationery Office, price 1d.

Sea Waves

And their Effect on Harbour Works

By J. M. LACEY, M.Inst.C.E.

WHEN a medium is in stable equilibrium, it has no kinetic energy, and its potential energy is a minimum, therefore any local disturbance involves a communication of energy to part of the medium, and it is usually by some force of wave motion that this energy spreads to other parts of the medium. A wave is a state of disturbance which is propagated from one part of a medium to another, thus energy passes, but not matter. Current, on the other hand, implies the passage of matter associated with energy.

Waves are either "free" or "forced." In a free wave, the disturbance is produced once for all, and is propagated according to the nature of the medium, or form of disturbance. Or the disturbance may continue provided the wave travels faster than the centre of disturbance. In a forced wave the disturbance continues to act so as to modify the propagation of waves already produced.

Waves in liquids may be classed as waves of oscillation, waves of translation, and ripples. When a layer of one fluid flows over another the surface of separation is necessarily unstable, so that waves are generated, and the waves in the surface separating the two fluids must depend on their relative densities, and velocities. The most familiar case is the creation of waves on a water surface due to the action of wind. An oscillating wave is thus, in the first place, the direct result of the force of the wind. It is comparatively short, high and superficial, the disturbance of the particles is greatest at the water surface, and diminishes rapidly with increasing depth. At the crest of the wave the motion of a particle of water is in the same direction as that of the wave, in the trough of the wave the motion of the particle is in the opposite direction. Waves of the sea are waves of oscillation.

Winds never for any length of time blow in the same direction, therefore it is exceptional to encounter a train of waves obeying a simple law; in general, two or more series of waves, not always moving in the same direction, are imposed one upon another. Some time after a storm, and even after the wind has abated, it will be observed that the period, or the interval of time of the breakers on the shore, has increased beyond what it was during the storm, or shortly after it has passed over. This increase in the period of the breakers indicates that the wave lengths in the offing, and in the deep sea, have increased since the storm; consequently, the wave velocity in the open sea must also have increased; but as the wind which created the waves has abated, the only form acting on the waves must be gravity. The weight of the rising water pressing downwards through the water below, and pushing up the water in front, thus propagating the waves. The result is an ocean roller travelling freely under the action of gravity.

Rankine's Theory

Rankine has shown that a theory of rolling waves might be deduced from that of the position assumed by a mass of water revolving in a vertical plane about a horizontal axis, and proves that in a mass of gravitating liquid whose particles revolve uniformly in a circle, a wavy surface of trochoidal profile fulfils the condition of uniformity of pressure. Such a trochoidal profile being generated by rolling, on the underside of a straight line, a circle whose radius is equal to the conical pendulum that revolves in same period with the particle of the liquid. See Fig. No. 1. (Mis. Scientific Papers, Part III).

If λ be the wave length from crest to crest and τ the period in seconds and fraction of a second—

$$\tau = \sqrt{\frac{2\pi\lambda}{g}}$$

When g represents the acceleration of gravity

$$\lambda = \frac{g\tau^2}{2\pi}$$

$$\text{The wave velocity } V = \frac{\lambda}{\tau} = \sqrt{\frac{g\lambda}{2\pi}}$$

The orbits of the particles are circles of radius r . If r_0 be the length of the tracing arm, or radius of the upper free trochoidal surface, or half the height of the wave, and r_y the tracing arm of the trochoidal surface, whose middle depth is y below the centre of the generating circle of the upper free surface—

$$r_y = r_0 e^{-\left(\frac{2\pi y}{\lambda}\right)}$$

That is, the radii of the orbits, or amplitudes of disturbance, diminish in geometrical progression as the depth increases in

arithmetical progression. The depth to which agitation extends depends primarily on the wave length, and only to a secondary degree upon its height.

In the extreme case of the cycloidal wave, with its cusps turned upwards, the highest that can exist without breaking, the ratio of centrifugal force to gravity is unity and the two arms are equal, that is $r_0 = R$ (see Fig. 1).

Period and Speed of Waves

The period of a wave is the time elapsing between the appearance of two crests or two troughs, at some fixed point or poles projecting vertically from the sea bed; it is also the time occupied by each particle in making a complete revolution, therefore the speed of a particle is to the speed of the wave as the circumference of the particle orbit is to the length of the wave. At the surface the speed of the particle will be

$$v = h \times \sqrt{\left(\frac{\pi g}{2\lambda}\right)}$$

Where h is the height of the wave.

Rankine states that the crest of waves rise higher above the level of still water than their hollows fall below it. The height of the centre of the orbit of the wave above still water is $\frac{\pi r^2}{\lambda}$, that is height due to the velocity of the particles. Therefore, the mechanical energy of a wave is double that due to the motion of its

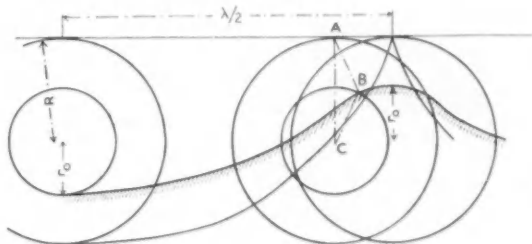


Fig. 1.

If B revolves in a vertical circle, and if $CA:CB::$ force of gravity: centrifugal force, the resultant is AB. A curve normal to AB will be the surface of equal pressure. Such a surface is a trochoid traced by B, which is carried by a Circle Radius AC rolling on the underside of a horizontal straight line. Height of wave $= 2r_0$. If λ = length of wave.

$$\lambda = 2\pi R.$$

particles only, there being an equal amount due to the mean elevation of the particles above the position where the water is still. If λ be the wave length, and h the wave height crest to trough, the height of the crest above still water level is

$$\frac{h}{2} + 0.7854 \frac{h^2}{\lambda}$$

And the depth of the trough below still water level will be

$$\frac{h}{2} - 0.7854 \frac{h^2}{\lambda}$$

Still water level being the level of the water surface when undisturbed by waves.

Sir G. Stokes states that in waves of a permanent type the motion is not purely oscillating, there being on the whole a gradual drift at the surface in the direction of propagation. It is true, that with the wind behind it, every deep-sea wave has a slight movement of translation or progression, known to sea men as the "Heave of the sea." In a gale it is very appreciable, but after the wind drops, and the waves change into "swells," the "Heave" rapidly diminishes, and, in the calm following the storm, becomes negligible. For waves in infinite depth, Sir G. Stokes gives the wave velocity as

$$V = \sqrt{\left\{ \frac{g\lambda}{2\pi} \left(1 + \frac{\pi h^2}{\lambda^2} \right) \right\}}$$

Where λ represents the wave length, h the height of the wave, crest to trough, and g the acceleration due to gravity.

Deep sea waves are waves of oscillation, but the statement that the particles revolve in circular orbits is an assumption which fits with the now generally accepted trochoidal theory of oscillating deep sea waves. The difficulty of proof is great, such observations as have been made by ocean waves support Rankine's theory. In the open sea the height, speed and length of waves

Sea Waves—continued

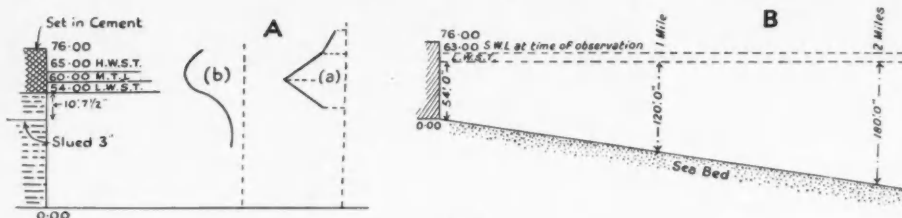


Fig. 2.

is limited only by the velocity of the wind, and also whether the wind is blowing against an existing swell due to a part gale, or in direction of an original swell. The most rapid increase of wave height occurs when a rising wind on the open ocean blows in the same direction as that in which a swell is running, and with a speed greater than that of the swell. Sometimes crests are formed on the waves by the wind urging the tops of waves at a greater speed than the body of the waves. Such crests have a motion of translation, and are a source of danger to small vessels at sea. The period of a single series of deep sea waves varies from a maximum of 24 seconds, in exceptional circumstances to large storm waves having a period of 6 to 9 seconds.

Waves of Translation

When the depth of water becomes reduced, vertical compression commences to operate appreciably upon the orbits, which then elongate into ellipses, the eccentricity increases as the depth decreases, the period and the time of revolution remaining the same, but the waves get shorter, and steeper by bottom friction, and the wave velocity becomes less. The paths of individual particles become ellipses, both major and minor axis decreasing with the depth, but the minor axis more rapidly than the major. When the wave length becomes great compared with the depths of water, and especially where there is a sloping beach, each of the waves of a series changes into a wave of translation. (See Fig. 3 (b).) A wave of oscillation tends to become a wave of translation in water of which the depth is half the wave length. In all depths in which it is possible to construct sea works, storm waves will in a greater or less degree become waves of translation. When waves advance into shallow water or meet a sloping beach, their velocity is retarded, and their length diminished, their period remaining the same. As the waves advance their slope becomes, steeper, the velocity of the particles increase, and their orbits are distorted in such a manner that the point of each wave gradually becomes steeper than the back, the crest advancing faster than the trough, this increase in height and motion of the particles approximate to the velocity of the wave, progressive motion is given, the wave ultimately curls over beyond the vertical, its crest falls forward, and the wave breaks into surf on the beach, when its maximum transporting power and destructive force is attained. Waves generally break on reaching water whose depth equals twice their height. Heavy ground swells have been known to break in

lowing sea floor, their length gets shortened by friction, and there is a tendency for each crest to overtake those in front, and to producing a short and hollow sea, dangerous to shipping.

Ground Swell

A ground swell is a product of wind waves, which are generated at some distant part of the ocean, and which travel across the ocean shorewards, and form long, low undulations.

Their effects extend to greater depths than that of ordinary wind waves, and they exert greater power of transmission near the bottom than short waves in the same depth. The long waves formed by a ground swell on approaching shallow water, where the depth is constantly diminishing, are increased in height and velocity, and exert more powerful and greater percussion effect on a sea wall or cliff than wind waves, and their backwash proves more destructive to the beach.

Height of Waves

The height of waves caused by the wind is generally dependent on the fetch, or line of exposure, that is, the distance the waves have been driven by the wind. There are several formulae in general use. Stevenson gives the rule

$$h = 1.5 \sqrt{Fn}$$

Where h represents the height of the wave in feet, crest to trough, during heavy gales, and Fn represents the fetch or distance of the line of exposure in nautical miles. In short reaches and violent squalls he gives the following rule:—

$$h = 1.5 \sqrt{Fn} \times (2.5 - \sqrt{Fn})$$

Fetch is not the only factor to be taken into consideration in estimating the height of waves. On the line of exposure, the fetch may be many miles, yet the height of the waves may be less than anticipated. In addition to fetch, the soundings of the sea bed as it approaches the shore should also be considered. When the soundings are steep the waves may come in with their size and force undiminished by friction of the sea bed. It is obvious that "fetch" does not hold good for large oceans. It is probable that few gales are of sufficient extent to act over larger distances, as a distance between Europe and America. Also winds never for any length of time are blowing in the same direction, and with the same force. Since the creation of ocean waves is in the first place due to the action of wind the importance of accurate estimates of average wind velocities should be recognised. Professor Zimmerman, of Berlin, from plotted observations gives

$$H = 0.44 W$$

Where H is the wave height in metres, and W the wind velocity in metres per second, Professor Vaughan Cornish states that the wave-raising power of wind is much greater when operating on water already in motion, than upon nearly smooth water.

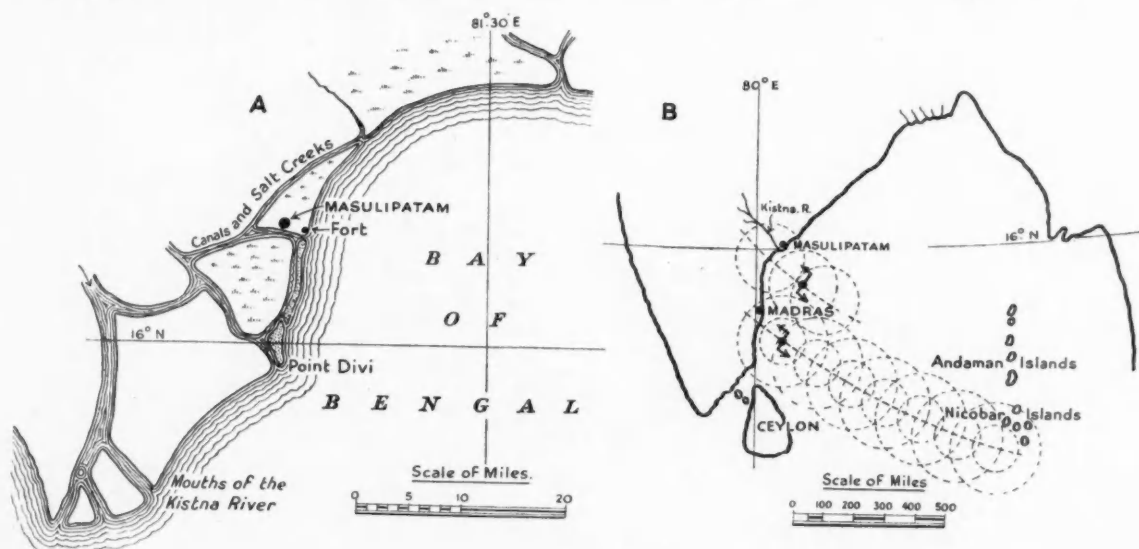


Fig. 3.

considerable depths of water. Except for long ground swells, the height of waves can never exceed the depth of water over which they travel. The retarding effect of bottom friction can best be observed in shallow water when an on-shore gale magnifies the waves into a dangerous surf. In deep water it forms the explanation of the dangerous seas in the Bay of Biscay in a heavy westerly gale, when, as Atlantic waves meet the shal-

The height of waves which may be exceeded when the wind has full opportunity to do its work is

$$V = 2.05 h,$$

where V is the wind velocity in statute miles per hour, and h the wave height in feet. ("Waves of the sea and other waves.") Storm waves in the North Atlantic ocean have been observed

Sea Waves—continued

to be 500 to 600 feet in length, with period of 10 to 11 seconds, and 44 to 45 feet in height. At the Tyne harbour the height of waves in bad weather varied from 32 to 40 feet. At the Tyne Head the soundings are steep, and the waves roll in with their size and form undiminished by friction of the sea bed. (Pro. Inst. Civil Engineers, vol. ccix, p. 214, and pp. 222, 223.) The average height of waves recorded are:—

Mediterranean Sea, 17 feet.

North Atlantic Ocean, 40 feet.

South Atlantic Ocean, off the Cape of Good Hope, 50 to 60 feet.

Force of Waves

The primary objective of every engineer is to collect the experience of others, discuss his observations on them, and present to the profession his results. In no case is this more evident than in the estimation of the force of waves, and the propriety carefully collecting facts that may help to a more accurate estimation of those forces, which are subject to no calculation, should not be neglected.

The force exerted by a wave depends much on local conditions. The effect of an ocean wave approaching a breakwater with deep water close in shore is different to the effect of the same approaching a shelving coast.

When a wave of oscillation rolls straight against a vertical wall in deep water, the wave undulations merely rise and fall against the face of the wall, and are reflected back without delivering any perceptible stroke, and in such cases this oscillation prevents a boat or vessel being dashed against the vertical surface, i.e., that of a ship's side, or a vertical breakwater. When waves travel up a slope, the vertical oscillation is converted into a motion parallel to the slope, the wave rises up, increases in height, the mass of water is thrown into the fore part of the wave, and progressive motion is given. Where water shoals gradually the retarding influence of friction is more felt, hence a breaking wave on a steep shore is more violent than on a flat shore. Where the depth is considerable in shore, and if the fetch or line of exposure in this direction of the wave producing wind is great, a sudden shoaling produces a high surf on the

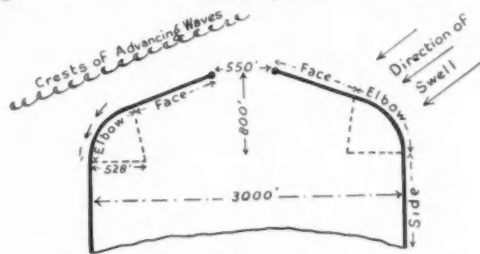


Fig. 4.

beach. The impact of a wave is greatest when an oscillating wave breaks suddenly in deep water on meeting an abrupt decrease in depth, as would be the case of a sloping foundation, or rubble mound, when the wave delivers its blow with the full dynamic force of the maximum speed of its particles.

When a gale has subsided more damage is often caused to sea works than when the gale is at its highest. The long smooth undulating ground swells, with its enormous destructive energy, occurring after a storm has abated, is the result of oscillations which have been gradually set up in a large mass of the sea by the wind, and is the type of sea running after the wind has dropped. It is transmitted to areas beyond the storm zone, and is caused by the sub-surface velocity exceeding the surface velocity. Such swells often travel at greater speeds than do the highest wind waves.

Examples of the Force of Waves

At Wick harbour in 1872 a monolith bound with iron bars and weighing 1,350 tons was torn from its seat and thrown leeward. In 1873, when another mass of concrete was substituted for the one washed away, 1,500 cubic yards of cement rubble weighing 2,600 tons, was in like manner displaced. Wick is exposed to the full force of the North Sea, with a fetch extending in a S.E. direction to the coast of Denmark, 500 miles distant.

At the Tyne foreshore blocks weighing 41 tons had been displaced in 27 feet of water.

In November, 1906, concrete blocks which were stacked three deep along the surface of Dover breakwater, which was 45 feet wide, were shifted in a heavy storm by high waves which broke over the breakwater. The force of the waves thus moving a column of concrete 120 tons in weight.

Mr. William Shields, M.Inst.C.E., states that at the breakwater at Peterhead, which is of the vertical type composed of concrete blocks weighing 40 tons each, laid in regular horizontal courses, joggled and set in Portland cement above low water, during the storm of October, 1898, blocks weighing 40 tons were displaced at the level of 36 ft. 7½ in. below the level of low water spring tides. A section of the breakwater weighing

3,300 tons down as far as 10 ft. 7½ in. below low water was bodily shifted, to the extent of two inches without the blockwork being disturbed. The waves acted on a surface 33 ft. by 34-ft., and from experiments made by Mr. Shields on sliding blocks on each other, he estimated that in moving the mass of masonry the waves must have exerted a force of 2,310 tons over the whole exposed area, equivalent to a pressure of two tons per square foot. Mr. Shields also states that in the waves responsible for the shifting of the mass, the water was thrown up to a height of 115 to 120 feet. (Note on the effect of waves on breakwaters. Engineering Conference, June, 1899. Pro. Inst.C.E., vol. cxxxviii.) Fig. 3 A and B gives a diagram

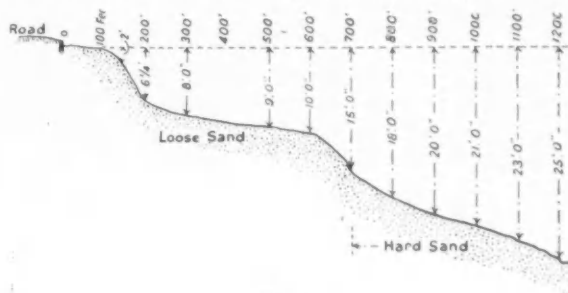


Fig. 4a.

of the conditions obtaining, the slope of the sea bed approaching the breakwater is 1 in 80. The sea deepens rapidly seawards of the harbour.

Mr. T. Stevenson, using a marine dynamometer at the Skerryvore Lighthouse, which is exposed to the full force of the North Atlantic ocean, ascertained that during the heavy westerly gales of 29th March, 1845, the force of the waves impact was equivalent to nearly 3½ tons per square foot. In the North Sea, at the Bell Rock, the force of wave impact was equivalent to 3,013 lbs per square foot. At Dunbar, in East Lothian, it amounted to 3½ tons per square foot. In the harbour works at Buckie, on the coast of Banffshire, observations extending over a period of several years showed the force of wave impact to be equivalent to three tons per square foot.

The greatest intensity of wave pressure is found near the surface, and acts on a comparative small area. The direct measurement of the mean intensity of pressure on a large area is hardly possible. Fig 3 A (a) shows the distribution of wave horizontal force against a sea wall as observed by Mr. T. Stevenson (Design and Construction of Harbours), and Fig. 3 A (b) shows Professor Luigi Luiggi's curve of wave pressure distribution (Pro., Inst.C.E., vol. ccxiv., p. 43).

At Colombo harbour a length of wall of the south-west breakwater, 28 feet wide, founded 20 feet below low water, was shifted inwards, by wave action, to the extent of 15 inches.

On November 6th, 1864, a great wave, called a tidal wave, swept some 17 miles inland north of Kistna River, and destroyed the town of Masulipatam, the headquarters of the district, situated 195 miles north of Madras, and 40 miles north of the mouth of the Kistna River. The coastal area of the Kistna district is extremely flat and low lying, being the deltaic formation of the River Kistna. The roadstead off the Coast of Masulipatam is shallow and shelving, and in calm weather there is always a ground swell. The great wave was the result of a cyclone which,

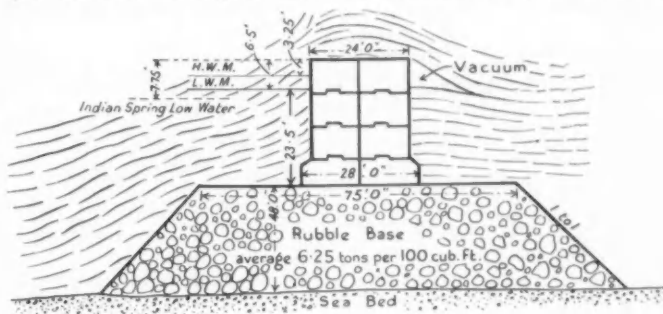


Fig. 4b.

starting somewhere about the Nicobar Islands, crossed the Bay of Bengal in a north-westerly direction, and struck the coast some 100 miles south of Masulipatam. The sea driven, into this bight of the coast before the storm, arrived at the very moment of high spring tide, and an enormous wave some 13 feet above ordinary high-water mark was borne inland. The extent of inundation was along 80 miles of coast, the farthestmost point reached by the wave was 17 miles inland. The surface inundated was estimated at 750 square miles, and there was considerable loss of life and much destruction of cattle. The receding wave left the town of Masulipatam covered with a thick deposit of black mud, roads were entirely effaced and covered with broken

Sea Waves—continued

trees and masses of prickly pear. Huge blocks of stone, forming the causeway over the marshes connecting the old fort with the town were uprooted and carried to a distance of over 60 feet. (See Figs. No. 3 A and B.)

The effect of an ocean swell, combined with the forces due to the direct action of wind waves, is exemplified in the damage caused to the Madras Harbour in the cyclonic storm of November 12th, 1881. The conditions obtaining at the Madras roadstead previous to the construction of the harbour have already been described in *The Dock and Harbour Authority* of October, 1940. (Harbours and ports of Circar and Coromandel Coasts of South India). The sea bed consisted of a large bed of shifting sand extending as far as six fathoms beyond which the bed of the sea

- (1) May vary from 1 to 3 ton per square foot.
- (2) The percussive action may cause the last row of blocks to be driven in, while the others are untouched.
- (3) Compression of air occurs when the blows of a wave compresses the small quantity of air between the joints, and this concussion is communicated to the water also in the joints—an action similar to that of the hydraulic ram. (See Fig. 4). (Records of the Government of India P.W.P., Serial No. 5, 1885, "Papers on the Madras Harbour.")

Karachi Port Trust

Excerpts from Administration Report for 1940-41

Finance

In round figures the Revenue Receipts for the year were Rs. 68,05,000 as against Rs. 70,60,000 (excluding contra items) in the previous year, a decrease of 4 per cent.

The Revenue Account expenditure on ordinary items was Rs. 64,68,000 as against Rs. 68,05,000 (excluding contra items) in the previous year, a decrease of 5 per cent.

The financial result was a surplus of Rs. 3,37,000 on the year's working.

Cargo

The total volume of imports and exports was 1,896,000 tons, or a decrease of 11.1 per cent. over the previous year's figure of 2,134,000 tons. Imports were 637,000 tons; exports 1,260,000 tons.

Shipping

The figures in a table in the Report indicate that foreign-going vessels entering the Port and using the Ship Wharves were less than those of the previous year by 193 in numbers or 30.5 per cent, and the net register tonnage was less by 612,286 or 30.8 per cent.

Coasting vessels entering the Port, whose cargo is mainly handled by lighters over the Juna Bandar, were less by 62 in number or 29.2 per cent. and the net register tonnage was less by 10,322 or 30.8 per cent.

Engineering Works

The cost of Engineering Works carried out during the year compares with the previous year, thus:—1940-41, Rs. 19,73,471; 1939-40, Rs. 19,67,999.

Dredging the Harbour

The total expenditure on dredging operations during the year amounted to Rs. 4,27,229 against Rs. 461,144 in the previous year.

As against 2,216,440 tons dredged in the previous year, 1,774,620 tons were dredged during the year.

Medical etc.

As a plague preventive measure, the usual anti-rat campaign was in force on the wharves, etc., and resulted in the trapping of some 4,000 rats, and in finding dead some 2,200.

The Report is signed by the Chairman, Col. D. S. Johnston.

Publication Received

Steel Sheet Piling.—The Appleby-Frodingham Steel Company of Scunthorpe, Lincs., have issued a neat little book of 184 pages, containing in compact form a quantity of useful information about steel sheet piling in general, but with particular reference to the types, known as Frodingham, which are rolled at their works. It is claimed for these types that an economy arises from the high strength of the piles for low cross-sectional dimensions, which allows them to be driven into the most difficult strata. Another advantage, arising from the high modulus, is the wider spacing of walings, which is rendered permissible in cofferdams and similar work. The fundamental principles for the design of sheet piling, as applied to retaining walls and cofferdams, are set out in a section of the book, followed by useful tables of a general nature. The Appleby-Frodingham Steel Company inform us that any responsible person making application and giving position and employer's name may have a copy free of charge.

Proposed New Danube and Adriatic Canal.

It has been announced by radio that in Germany plans are being prepared for a new canal to connect the River Danube with the Adriatic Sea, with the obvious design of obtaining direct access to the Mediterranean.

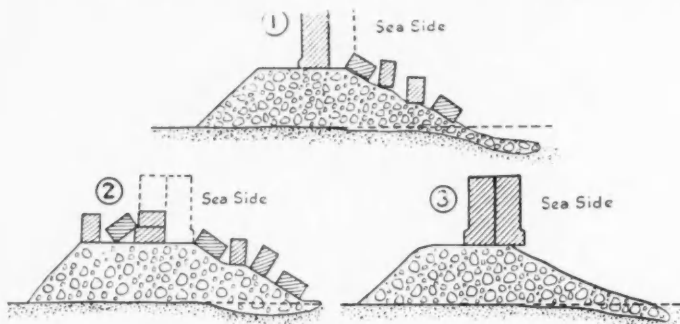


Fig. 5. Sketch showing sections (1, 2 and 3) of the Elbow after the storm.

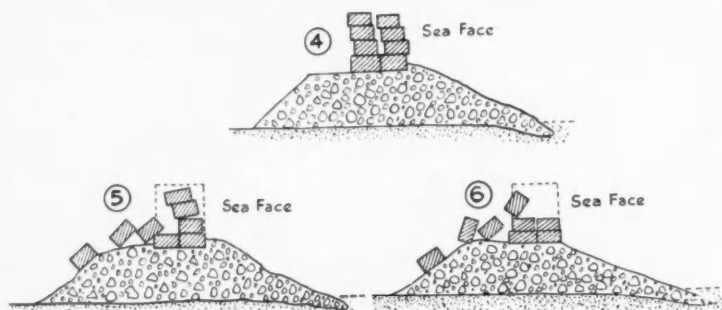


Fig. 6. Sketch showing sections (4, 5 and 6) of face after the storm.

is stiff blue clay with a small depth of firm sand on it. The beach slope is steep. Fig. 4 (b) shows soundings at low water taken with great care and precision before the harbour was constructed, and there is always a heavy surf breaking on the shore. Observations show that in the south-west monsoon the strike of the waves never exceeds an angle of 30 degs. with the coast line, the waves coming in from the south-east; and the reverse is the case in the north-east monsoon when the strike of the wave is from the north-east, also having a maximum angle of 30 degs. with the coast line. Fig. 4 shows the plan of the harbour entrance as constructed in 1881, and Fig. 4 (a) shows a section of the piers as then constructed.* The piers were built without bond, similar to the Manora breakwater at Karachi.

The cyclone of November 12th, 1881, originated somewhere in the vicinity of Nicobar Islands and travelled from east to west in a north-westerly direction, crossing the Bay of Bengal at its widest part, and struck the Coromandel coast at Pondicherry some 100 miles south of Madras. The storm exhausted its greatest force while crossing the Bay of Bengal, which would account for the high destructive sea, far beyond what may have been expected from meteorological indications. The waves of the sea due to the wind came with great regularity from a direction a little north of east, the breakers being parallel to the north "face" of the piers (see Fig. 4). The swell reflected from the face meeting the waves direct from the sea, set up a huge confluent wave, which would closely hug the "elbow" following it round and tearing up the blocks, so that the outer row fell outwards, and the inner row inwards. In the "face" the piers rocked and fell inwards (see Figs. 5 and 6). The side pier arms were not damaged. The waves poured over the harbour arms, and caused a current from the harbour outwards through the entrance.

Sir G. L. Molesworth, who inspected the damaged harbour in March, 1882, and made a careful investigation of the below-water damage in a diver's suit, has noted the effect of a wave with a ground swell on a harbour as built at Madras, as—

- (1) Direct blow of the wave on the outer blocks.
- (2) Percussive action communicated from one block to another.
- (3) Compression of air joints.
- (4) Dragging action of the wave on the top block.
- (5) Vacuum formed behind the receding wave.

*The weight of each block was estimated at 27 tons.

Notes of the Month

Increase in British Canal Traffic.

Increasing quantities of coal are reported to be carried in the area of the Warwickshire coalfields, following the recent establishment of a central control system.

Tees-Side Post-War Development.

The Tees Conservancy Commission have appointed a special committee to deal with the question of local development and have called for a report from their engineer, Mr. P. A. R. Leith.

Clyde Navigation Trust.

At the recent annual meeting of the Clyde Navigation Trust, Mr. William Cuthbert was re-elected chairman for the ensuing year. Mr. James Leggat has been elected deputy-chairman in place of the late Capt. J. H. Maurice Clark, V.D., R.N.V.R.

London Stevedore Association.

The London Master Stevedores Association has now been registered a limited concern by guarantee without capital. Apart from taking over the old association, the objects of the new body are "to amalgamate or federate master stevedores, master porters and the like, and to promote the trade of the Port of London."

Suggested Additional Warehouse Accommodation at Colombo.

At a recent meeting of the Colombo Port Commission, the question of providing additional warehouse accommodation for inward cargo was raised and after hearing several instances of delays to ships due to congestion at warehouses, the Commission referred the matter to the chairman and the harbour engineer for report.

Developments at Danish Ports.

Extensions of port accommodation are in contemplation at Skagen (Skaw) at an estimated cost of 4,800,000 kroner, of which an instalment to the extent of 800,000 kroner is to be put in hand forthwith. Another important project estimated to cost 12 million kroner is under consideration for the Port of Frederikshavn.

Serious Dock Thefts at Bristol.

Seven men have been sentenced at Bristol to six months imprisonment with hard labour for the theft from the docks of 1,079 lbs. of cheese and 899 lbs. of jam and marmalade. For the prosecution it was stated that this was the first time it had been possible to bring before the Court men who had been responsible for stealing food—and rationed food at that—in such enormous quantities from the docks.

Dredging at Southern United States Ports.

Dredging operations are reported to be in hand at Gulfport Ship Channel in Mississippi Sound, in the South-eastern part of the State of Mississippi, approximately 90 miles by water West of Mobile Harbour, Alabama, and 78 miles East of New Orleans, Louisiana. Also in the inland waterway from Norfolk, Virginia, to Beaufort Inlet and in Beaufort Harbour, North Carolina. In both cases the quantity of spoil to be removed is estimated to exceed 1½ million cubic yards.

Obituary.

The death took place at the end of November of Mr. Edward Albert Moorhouse, Solicitor to the Mersey Docks and Harbour Board, after 44 years spent in their service. After holding various subsidiary positions, he became Solicitor to the Board in 1934. He took a prominent part with the late Sir Walter Thorne, his predecessor, in the formation of the Dock and Harbour Authorities' Association. Since 1934, he had also been Clerk to the Wallasey Embankment Commissioners.

New Mersey Dock Board Solicitor.

Mr. Ronald Henry Bransbury has been appointed Solicitor to the Mersey Docks and Harbour Board in succession to the late Mr. E. A. Moorhouse, whose decease is recorded above. Mr. Bransbury was born in 1899, educated at St. Paul's School, London, and served articles with a Liverpool firm, being elected to a Travers Smith Scholarship of the Law Society. He entered the service of the Dock Board in 1934 as assistant to the Solicitor.

Italian Inland Waterway Development.

It is reported that a project is under consideration for the construction of a Milan-Cremona-River Po Canal with harbours at Milan and Cremona. It is estimated that the canal will cost 427 million lire and that the constructional works at the ports of Milan and Cremona will cost 155 and 18 million lire, respectively. The Italian government will provide 60 per cent. of the outlay, the remainder to be divided between the provinces and cities of Milan and Cremona.

Tyne Improvement Commission.

Alderman R. Irvin, of Tynemouth, has succeeded the late Alderman G. D. Gascoigne as chairman of the Harbour and Ferry Committee of the Tyne Improvement Commission.

Appoint of Canals Director.

The appointment is announced of Brigadier-General Sir Osborne Mance as Director of Canals in the Ministry of War Transport, for a temporary period, without pay.

New Hostel for Colonial Seamen at Tyneside Port.

Forming part of a programme for extended accommodation for foreign and colonial seamen on Tyneside a second hostel for Colonials has been opened at North Shields. It is proposed to make provision for Moslem and Adenese seamen at South Shields.

Alterations at Port of Marseilles.

An announcement has appeared in the press to the effect that a certain number of electric quay cranes have been transferred from the Bassin de la Joliette to the Bassin du Maréchal Petain at Marseilles.

New American Anchorage Regulations.

New anchorage regulations for vessels in the navigable waters of the United States have been issued under Presidential authority by the United States Coast Guard. The regulations confer upon the Coast Guard full control over the movements of all vessels in United States harbours.

American Dock Construction in Red Sea.

A report from Washington, U.S.A., has stated that under the Lease-Lend Administration and the immediate direction of the United States Military Mission to the Middle East, arrangements are in hand for the construction of extensive warehouses, docks, railway sidings and aircraft landing grounds in the Red Sea area.

Bombay Port Trust.

Major-General F. V. B. Witts, C.B.E., D.S.O., M.C., Commander, Bombay District, has been appointed to fill the vacancy on the Board of the Bombay Port Trust caused by the resignation of Brigadier C. E. R. G. Alban, D.S.O., Captain G. V. G. Beamish, R.I.N., Naval Officer-in-Charge, Bombay, succeeds Captain R. A. Melhuish, R.I.N., who has resigned.

Channel Rectification in Guadeloupe.

In consequence of the completion of dredging operations at Pointe-à-Pitre, Guadeloupe, in the French West Indies, the navigable channel has been straightened. Before the work was undertaken, vessels over 170 metres in length were unable to reach the port owing to the winding course of the channel and this was regrettable in view of the provision about six years ago of new spacious quays.

Completion of American Dry Dock.

The great new dry dock at the Navy Yard's League Island, Philadelphia, has just been completed at a cost of ten million dollars. It is of outstanding size, 1,100-ft. long by 150-ft. wide, and is designed for the construction of gigantic new battleships for the United States Navy. A series of these docks are being constructed to cope with the huge shipbuilding programme which is now under way.

New Waterside Oil Terminal at Philadelphia.

A new oil depot or terminal has been put into commission at the waterside terminal of the Atlantic Refining Company at Fort Mifflin on the Delaware River. The terminal which cost \$1,500,000 comprises a large cargo depot, four storage tanks, pumping equipment and two 16-in. pipe lines leading to the Point Breeze Refinery, 5 miles distant. There is also a large administration building. The store tanks have a capacity of 80,000 barrels each and thus can accommodate freights for two large tankers. Eventually accommodation will be provided for three 540-ft. tankers simultaneously.

Traffic at Port of London.

Under powers contained in Regulation 74 of the Defence (General) Regulations, 1939, and other powers, the Minister of War Transport has by the Control of Traffic at the Port of London Order, 1941, authorised the Port Emergency Committee to require owners of barges and lighters to make returns showing the number of craft empty or booked for immediate requirements, the number laden but undischarged after four working days from the time the destination was reached, and the number under load and awaiting destination after six working days from the date of loading. All owners of barge-towing tugs and launches are required to make returns showing the work performed each day.

The New York Free Port or Foreign Trade Zone

Report on Progress

In an article in the *Shipping Register* (Montreal) by Mr. C. H. West, Assistant Trade Commissioner of Canada, the following statistics are quoted from an official report on the Foreign Trade Zone at Stapleton, Staten Island, New York, following an investigation made under the direction of Mr. La Guardia, Mayor of New York, by two Commissioners. There had been complaints made in connection with the operation of the Zone, but the investigators found that most of the complaints were unsupported by evidence and they state that the Foreign Trade Zone has definitely demonstrated its value as a stimulant to trade and commerce.

It will be recalled that the Foreign Trade Zones Board, established under the Celler Act for the purpose of regulating the various zones throughout the country, approved the establishment in 1936 at Stapleton, Staten Island, of the first foreign trade zone in the United States. For over a year this was operated by the City of New York as a municipal enterprise. This did not prove financially successful, and finally, after recommendation by an advisory committee, the city contracted with a private corporation as zone operator.

The following table shows the volume and value of goods passing through the zone into customs territory, and the duties paid thereon during the period of its operations up to 1939.

		Weight Lbs	Value \$	Duty \$
1937	...	7,493,366	173,216.61	29,936.26
1938	...	17,731,652	2,643,437.51	345,635.70
1939	...	59,292,481	4,201,543.00	732,167.23

Non-dutiable goods imported through the zone are shown in the following statistics, which indicate a considerable increase in this phase of the Zone's operations:

		Lbs	\$
1937	...	377,955	41,965.18
1938	...	14,241,033	1,086,423.15
1939	...	57,106,217	4,081,852.00

In the case of non-dutiable goods, the reason for using the zone is not at first apparent. However, sometimes non-dutiable goods are brought into the zone for the purpose of processing together with dutiable goods. In other cases the dutiable or non-dutiable character of the merchandise cannot be determined until after certain tests have been made.

As pointed out in the report referred to above, one of the primary purposes of the zone is to encourage transshipments and re-exports. The following table shows the operation of the Zone in this direction.

		Lbs	\$
1937	...	1,485,198	59,824.00
1938	...	1,046,761	151,951.40
1939	...	4,617,779	732,167.23

Of the volume and value for 1939, 1,960,879 pounds were dutiable at a value of \$225,831.62 while 2,656,900 pounds at a value of \$281,729.05 were duty free. Indicating that the increase in business in the Zone is independent of general favourable conditions for foreign trade, total imports of the United States for 1939 were valued at \$2,276,288,474 as compared with \$3,009,852,459 in 1937. On the other hand, imports into the Zone increased as shown in the following table:

	Value of all Cargoes Received	Value of Cargoes Transhipped	Value of Cargoes Directly Imported*	Value of Cargoes on Hand, as at Dec. 31	Percentage of Cargoes Transhipped in Relation to Cargoes Received
1937	1,174,293.00	59,824.00	215,181.79	899,287.21	5.0
1938	5,752,071.17	151,951.10	3,729,860.66	2,769,546.62	2.6
1939	39,020,030.00	507,560.67	8,292,395.00	18,124,818.00	1.3

That the upward trend has been continued during 1940 is evident from the following extract from a recent issue of the *New York Times*.

During 1940 there were received at the zone 130,449 long tons of foreign merchandise valued at \$36,619,489 and 62,103 long tons of domestic merchandise valued at \$46,811,579. In the same period there was shipped to foreign countries from the zone 129,625 long tons of merchandise valued at \$29,083,784 while 62,709 long tons of merchandise valued at \$51,910,418 was entered into customs territory of the United States from the zone. Total receipts and shipments represented an increase over 1939 of 147 per cent in weight and 156 per cent in value.

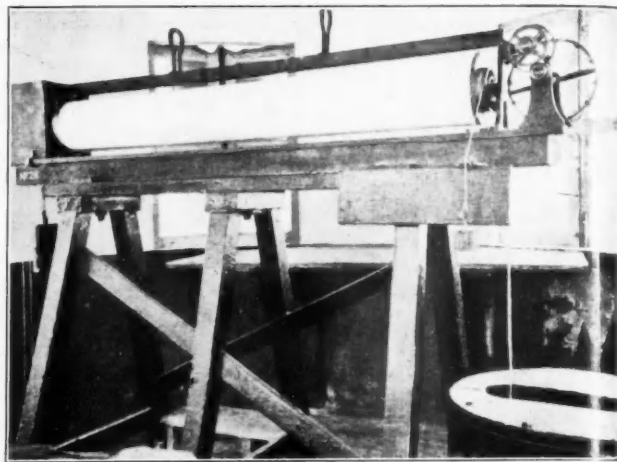
Commenting on the Report, Mayor Mr. La Guardia, said:

"This almost unbelievable increase was brought about in the face of the total cessation of business with Germany, Japan and the mid-European countries. Shipments to and from France had practically disappeared by the end of 1940 while shipments to Great Britain increased enormously. In addition, trade with Latin America, China and the Dutch East Indies boomed and accounted in large measure for the increase."

The Bombay Port Tidal Observatory

A short distance northward from the Gateway of India is located a small building which houses the tide gauge for the Port of Bombay, where continuous graphs are recorded showing the rise and fall of each tide in the Bombay Harbour.

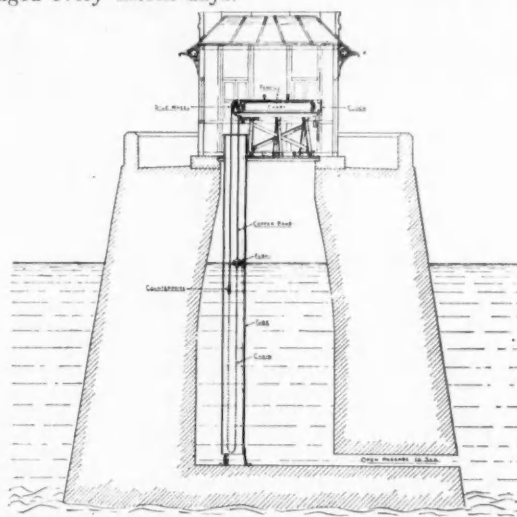
The illustration shows the type of tide gauge in use. This consists of a drum geared to a clock at one end, and at the other is a stud wheel, on which is carried a copper band supporting a float in the well. The whole apparatus is mounted on a cast-iron bed plate supported on trestles. The drum carries the paper



The Tide Gauge.

on which the tidal diagram is registered; its position, as will be seen from the illustration, is horizontal. Immediately above the drum is a guide and this carries the traveller to which a pencil is attached. The traveller is connected by a wire to the gearing at the float end of the drum, and with the rise or fall of the float due to the tide drives the stud wheel, by means of the copper band previously referred to. This band is perforated with holes of the same diameter as the studs in the wheel and at the same distance apart. Through the arrangement of gearing attached to the axle of the stud wheel the traveller is operated. This can be so arranged to enable the working scale of the tidal diagrams to be varied from the natural scale to a convenient one to suit the range of tide. Scales vary usually between 1/1 and 1/2. In Bombay the scale used is 1/2 full size and tides up to a range of 20' can be recorded. Close to the end of the band is attached a weight as a counterpoise to the float and a chain which is exactly equal in weight, length for length, to the copper band, and this ensures perfect balance.

The drum completes one revolution in 24 hours and the pencil as it travels along the guide track traces the curve of the tide. Two high and two low tides are recorded in this time. The chart is changed every fifteen days.



Cross Section showing the arrangement of the Observatory.

A member of the Port Trust staff attends daily. The curves of the tide are outlined by the attendant in a particular colour for that day to enable easier reading being made. A daily check of the level of the water is also made from the full-size graduated staff fixed outside on the sea wall, and a corresponding reading is made from the gauge itself. The clock is checked daily from

*Abridged from an article in the "Port of Bombay Magazine."

Bombay Port Tidal Observatory—continued

standard time. It is essential that the greatest accuracy is maintained.

The charts are forwarded to the Geodetic Branch Survey of India, Dehra Dun, and are used in the prediction of future tides, which are based on harmonic analysis made by the Kelvin and Roberts Tide Predicting machine.

The earliest recorded tidal observations in India were those taken by a James Kydd at Kidderpore Docks on the Hooghly River in 1806. In 1833 as a result of investigations carried out in England, the Asiatic Society was requested by the Governor-General to take up the question of tidal observation along the Indian Coast. On the West Coast of India the first tide tables produced were those of Benjamin Norton at Bombay in 1832. From then until 1877 numerous observations were made by various people. In July, 1877, the Government of India passed a resolution entrusting the general superintendence and control of systematic tidal observations to the Survey of India.

Notable Port Personalities**XVIII.—Mr. F. E. Wentworth-Sheilds, O.B.E., M.Inst.C.E.**

Mr. Francis Ernest Wentworth-Sheilds, formerly Docks Engineer of the Southern Railway, is the son of the late Mr. F. W. Wentworth-Sheilds, M.Inst.C.E., of Dublin, who became City Engineer of Sydney, N.S.W. He was educated at St. Paul's School where he gained junior and senior scholarships. On



Mr. F. E. WENTWORTH-SHEILDS, O.B.E., M.Inst.C.E.

leaving school at the age of 16, he was, after a short apprenticeship to his father, appointed on the staff of the famous public works contractor, the late Mr. T. A. Walker, under whom he was employed on the construction of the Manchester and Salford Docks, part of the Ship Canal undertaking. Three years later he entered the drawing office of the London and South-Western Railway, where he attracted the favourable notice of Mr. (afterwards Sir) Harley Dalrymple-Hay, to whom he became personal assistant.

In 1892, when the Railway Company purchased the Southampton Docks, Mr. Wentworth-Sheilds was appointed assistant to Mr. Maurice F. G. Wilson (now Hon.M.Inst.C.E.), at that time Resident Engineer in charge of the scheme for the reconstruction of the Prince of Wales Graving Dock and of a mile length of deep water quays. After some intervening experience in railway construction, Mr. Wentworth-Sheilds returned to Southampton for further dock work, until, in 1905, he took up a post as Resident Engineer on the Isna Barrage works in Upper Egypt which, unfortunately, owing to an attack of illness, he had to leave prior to completion.

In 1907 he was back again at Southampton supervising the design and construction of the world-famous Ocean Dock, destined for the reception of the transatlantic leviathans of the Cunard-White Star Line. For a Paper read before the Institution of Civil Engineers, descriptive of the engineering operations, he was awarded the Robert Stephenson gold medal.

In 1909, he was appointed Docks Engineer to the London and South-Western (now Southern) Railway and on the conclusion of the Great War of 1914-1918, in which he rendered signal service in connection with the work at the ports, he carried out the notable scheme of quay extension along the North bank of the River Test, including the King George V Graving Dock, before his retirement from active work in 1936.

Mr. Wentworth-Sheilds is a Vice-President of the Institution of Civil Engineers and a Past-President of the Institution of Structural Engineers. He received the distinction of O.B.E. in 1920. He is joint author of a text book on Reinforced Concrete Piling and has written a number of technical papers and articles. In 1921, he delivered the Vernon-Harcourt Lecture on the subject of Dock Equipment.

New Slipway at Orient Bay, Ontario, Canada**An Interesting Installation in Land-locked Waters**

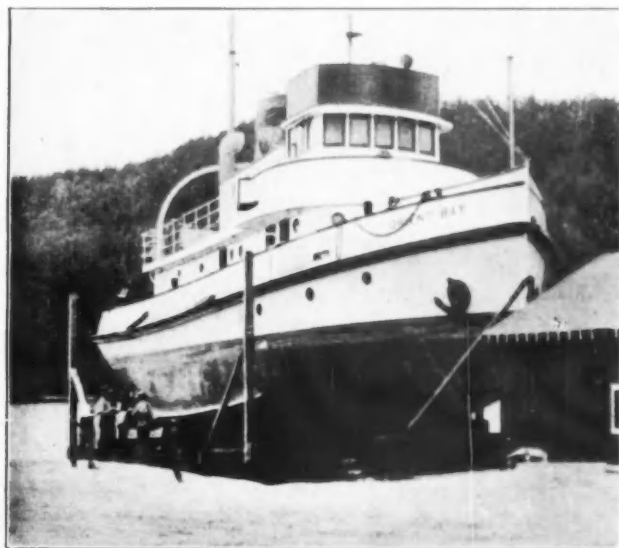
On May 15th, 1940, 86 years after the first installation of a Crandall type slipway in East Boston, Massachusetts, U.S.A., work was begun at Orient Bay, Ontario, by Crandall Dry Dock Engineers, Inc., of Cambridge, Massachusetts, on a 300-ton slipway for the Power and Paper Company of Toronto, Ontario. Nine weeks later, the new slipway was put into commission and the first vessel was taken on the cradle and withdrawn from the water in the Bay.

Orient Bay is located in Lake Nipigon which lies to the north of Lake Superior. The Abitibi Power and Paper Company draws its supplies of pulp wood from logging operations to the north of the lake. Immense booms are assembled at the northern end of the lake and towed by powerful tug boats to the mouth of the Nipigon River at the southern end. But the Nipigon River—which incidentally, provides some of the best trout water in all Canada—is a shallow unnavigable stream, so the logs must be floated down the Nipigon to Lake Superior.

Because of this land-locked condition of Lake Nipigon, the tug boats, weighing 270 tons, were of necessity built on the lake, at Orient Bay. And, after several years of hard service, they required withdrawal from service for inspection and repairs. It was therefore decided to construct a 300-ton slipway at Orient Bay, similar to the one installed at Iroquois Falls in 1935, and the Crandall Dry Dock Engineers, Inc., were again assigned the problem of design and the task of construction.

Special Conditions

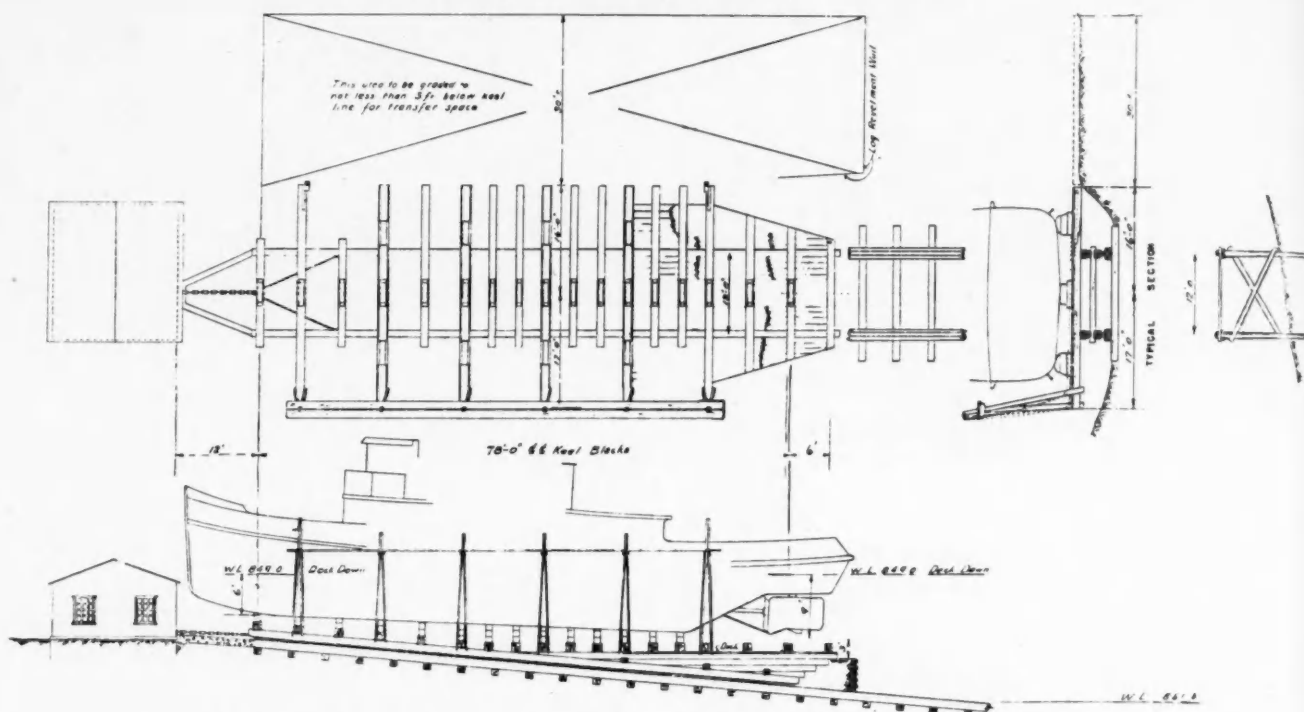
After study it was decided to construct the slipway on the ways originally used for building the two tugboats, with the tracks extending beyond the old launchways. Moreover, the cradle was designed so that vessels could be moved transversely, so as to allow of several craft being repaired at one time. Thus the facilities can be put to full use during the long winter season when the fleet is out of commission.



A Vessel on the Slipway.

The track is 341-ft. long. It is laid down to a uniform gradient and is of the two-way type. The inner 200-ft. of track is supported by the launchways, the balance by spruce piling. After driving these piles to adequate penetration and resistance in the sand subsoil, they were cut accurately to the prescribed gradient by divers. Then the track was sunk in place, accurately aligned and secured to the piling.

New Quay at Willington-on-Tyne—continued



Slipway at Orient Bay, Ontario, for Abitibi Power and Paper Company. 300 tons capacity.

The Cradle

The cradle moves on a system of free rollers. These run between flat steel rail plates which are fastened to the bottom of the cradle runners and to the top of the tracks. It is operated by a single open-link hauling chain and a steam hauling machine sufficiently powerful to handle a capacity load in 15 minutes.

Four sliding bilge blocks on each side of the cradle are operated by chains and hand winches located on the slipway platform. The

latter is placed on the port side of the cradle and supported by braced uprights fastened to the transverse beams. The general dimensions are as follows:—

Length of cradle over keel blocks	...	78 feet
Length of cradle overall	...	84 feet
Width of cradle	...	33 feet
Depth of water over keel blocks, forward	...	6 feet
Depth of water over keel blocks, aft	...	9 feet

The Port of Chittagong

Excerpts from Administration Report for 1940-41

The result of the year's working as compared with that of the previous year is as follows:—

	1939-40	1940-41
	Rs.	Rs.
Income, General Account	9,11,097	6,51,095
Expenditure, General Account	7,91,436	8,63,183
Net Revenue	1,19,661	—2,12,088

Income.—The income of the year shows a fall of Rs. 2,60,002 from that of the previous year.

Expenditure.—The expenditure during the year amounted to Rs. 8,63,183 as against Rs. 7,91,436 in the previous year, representing an increase of Rs. 71,747.

River Improvement Works.—Dangar Char Training Wall. Construction of this work proceeded smoothly and at the end of the year the greater part of the work was finished.

Gupta Left Bank Training Wall.—Considerable progress was made with this work, which was sufficiently advanced by the monsoon to commence the final improvement of the Gupta Crossing Bar.

Juldia Training Wall.—In view of the rapid widening of the river between low water lines below the Juldia training wall it was necessary to obtain control of the river by extending the Juldia training wall. The sanction of Government was obtained to a 3,000-ft. extension of the wall in the form of a half-tide wall of height 10-ft. above low water level, and a stone apron extension 1,200-ft. long, the total estimated cost being Rs. 2,95,000. The funds were provided by re-appropriating the amount from the Rs. 4,15,000 sanctioned for the construction of the Upper Juldia Protective wall, it being the intention to carry out part of this work for the time being, in the form of a single spur dyke estimated to cost Rs. 1,20,000.

Trade of the Port.—The following statement shows the tonnage of goods that passed through the Port during 1940-41, compared with that of the preceding year:—

Grand Total Trade	1939-40	...	tons	578,329
	1940-41	...	tons	367,429

Shipping.—During the year under report 489 vessels of the registered net tonnage of 389,321 tons entered the Port as compared with 693 of a registered net tonnage of 572,527 tons in the previous year.

The Institute of Transport Examinations

Amendments to Regulations

The Council of the Institute of Transport have announced the following amendments to the Examination Regulations:—

Form of Pass List: The Pass List in future will show candidates who have distinguished themselves as having been awarded 1st class and 2nd class honours.

Admission to Studentship: The existing regulations Nos. 6, 7 and 8 are cancelled and the following is substituted:—

“There is no Studentship examination but candidates will be regarded as qualified to apply for election as Students if they have passed the School Certificate Examination or some other general educational examination of similar standard, acceptable to the Council, or if they are able to satisfy the Council that they have reached a good educational standard and are capable of pursuing satisfactorily courses of study for the Graduateship and Associate Membership examinations of the Institute.”

Associate Membership Examination: The following regulation is added:—

“Candidates for Associate Membership, who are less than thirty-five years of age and who are able to satisfy the Council that they are suitably qualified by education and experience, may be permitted to submit a thesis in lieu of the Associate Membership examination. An application for permission to offer a thesis must include and proposed title and a synopsis. The completed thesis must be typed and be submitted in duplicate. It must be accompanied by the Associate Membership examination fee, a declaration that it is the candidate's own work, and the names of two corporate members who can certify the declaration. The examiners may test the candidate on the subject of the thesis either orally or in writing. A thesis must show practical and theoretical knowledge of transport and should be a record of original thought or research, contributing to the knowledge of transport, or a critical treatise on existing information or practice. Importance will be attached to the literary presentation of the thesis.”

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this Journal should not be taken as an indication that they are necessarily available for export.



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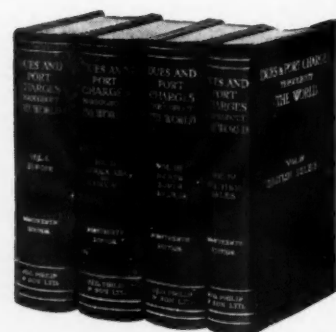
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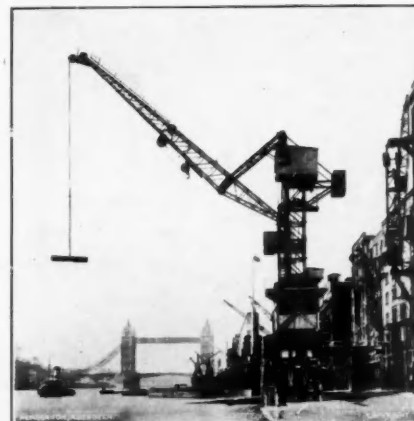
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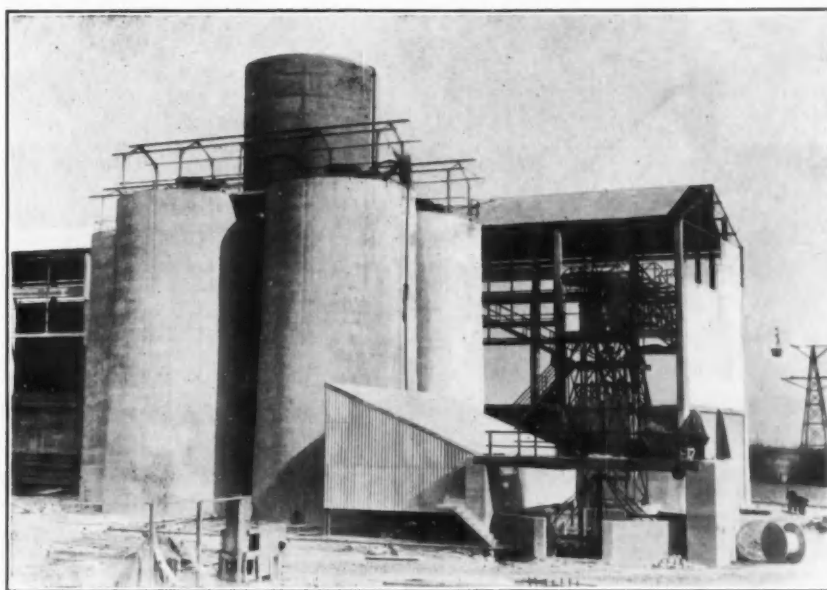
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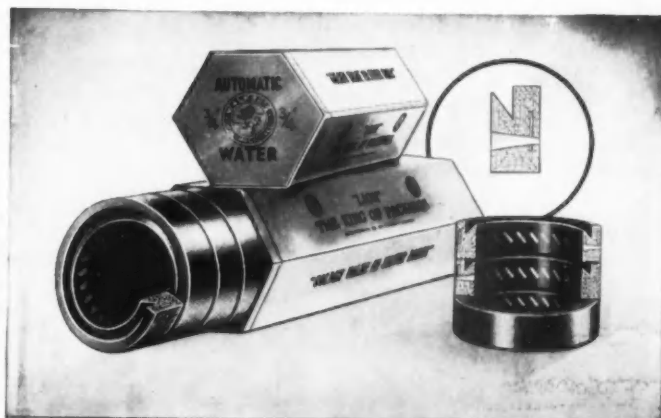
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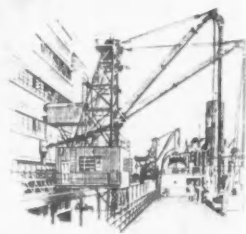
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